INVERTER POWER SUPPLY

IS-800CA/1400CA

USER MANUAL

990-380 REV H

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Revision Record

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B	43838	09/15	Added new pictures, updated Programming data, updated to Amada Miyachi America format.
C	44980	06/18	Added Ethernet/IP Appendix to manual.
D	45546	07/19	Update EtherNet/IP™ terminology + content
E	45804	04/20	Update Company Name (Amada Weld Tech) + Model Names
F	46130	12/20	Update I/O Schematics in Appendix B
G	46311	04/21	Add EU Disposal statement
H	47208	01/24	Update Mounting Dimensions, Duty-Cycle and Manual Title

FOREWORD

Thank you for purchasing an AMADA WELD TECH IS-800CA/1400CA Inverter Power Supply. For the rest of this manual, the **IS-800CA/1400CA** will be referred to simply as ***the Power Supply***.

Upon receipt of your equipment, please thoroughly inspect it for shipping damage prior to its installation. Should there be any damage, please immediately contact the shipping company to file a claim, and notify us at:

AMADA WELD TECH INC.
1820 South Myrtle Avenue
Monrovia, California 91016
Phone: (626) 303-5676
FAX: (626) 358-8048
e-mail: info@amadaweldtech.com

About This Manual

The purpose of this manual is to supply operating and maintenance personnel with the information needed to properly and safely operate and maintain the IS-300CA Inverter Power Supply.

We have made every effort to ensure that the information in this manual is accurate and adequate. The contents of this manual are subject to change without notice.

Should any questions arise, or if you have suggestions for improvement of this manual, please contact us at the above location/numbers.

AMADA WELD TECH is not responsible for any loss due to improper use of this product.

This manual covers the following models:

Original Model Name	Original P/N		Current Model Name	Current P/N
IS-800CR, 380V, non CE	IS-800CR-xx-xx	→	IS-800CA/380	IS-800CA-xx-xx
IS-800CR, 380V, CE	IS-800CR-xx-xx	→	IS-800CA/380/CE	IS-800CA-xx-xx
IS-800CR, 480V, non CE	IS-800CR-xx-xx	→	IS-800CA/480	IS-800CA-xx-xx
IS-800CR, 480V, CE	IS-800CR-xx-xx	→	IS-800CA/480V/CE	IS-800CA-xx-xx
IS-1400CR, 380V, non CE	IS-1400CR-xx-xx	→	IS-1400CA/380	IS-1400CA-xx-xx
IS-1400CR, 380V, CE	IS-1400CR-xx-xx	→	IS-1400CA/380/CE	IS-1400CA-xx-xx
IS-1400CR, 480V, non CE	IS-1400CR-xx-xx	→	IS-1400CA/480	IS-1400CA-xx-xx
IS-1400CR, 480V, CE	IS-1400CR-xx-xx	→	IS-1400CA/480/CE	IS-1400CA-xx-xx

CONTENTS

Page

Chapter 1. System Description

Section I: Features 1-1
- Basic and Advanced Units 1-1
- Advanced Models Only 1-2

Section II: System Components 1-3
- Front Panel 1-3
  - WELD POWER Lamp 1-3
  - READY Lamp 1-3
  - START Lamp 1-3
  - WELD Lamp 1-3
  - TROUBLE Lamp 1-3
  - RESET Pushbutton Switch 1-3
  - WELD ON/OFF Pushbutton Switch 1-3
- Internal Components 1-4
  - Connecting Terminal Strip for External Input / Output Signals 1-5
  - Charge Indicator Lamp 1-6
- External Connections 1-7
  - Cooling Water Pipe Connectors 1-7
  - RS-485/RS-232C Connector 1-8
  - Transformer Sensing Connector (Optional Toroidal Coil) 1-9
- MA-660A Program Unit (“The Pendant”) 1-10
  - TROUBLE RESET key 1-11
  - CURSOR Keys 1-11
  - +ON/-OFF Keys 1-11
  - ENTER Key 1-11
  - MENU Key 1-12

Chapter 2. Installation And Setup

Section I: Planning 2-1
- Environmental Factors 2-1
- Space and Mounting Requirements 2-1
- Power Requirements 2-2

Section II: Installation 2-3
- Unpacking 2-3
- Installation 2-3
  - Mounting the Power Supply 2-3
- Electrical Connections 2-4
  - Input Power Connections 2-4
- Breaker 2-5
  - Breaker Rated Current 2-5

CONTENTS (Continued)

Page

Input / Output Cable 2-6
Output Power Connections 2-7
Signal Sensing Connections 2-8

Section III: Cooling Water 2-9
Cooling Water Requirements 2-9
Cooling Water Hose Connections 2-9

Chapter 3. Using Programming Functions

Section I. Introduction 3-1

Section II. Programming Options For Basic and Advanced Models 3-2
1. MENU Screen 3-2

2. POWER SUPPLY STATE Screen 3-2
LCD CONTRAST 3-2
CONTROL # 3-3
PROGRAMMED DATE 3-3
POWER SOURCE FREQUENCY 3-3
LANGUAGE 3-3
MA-660A ROM VERSION # 3-3
MA-660A (IS-800CA/1400CA) PROGRAM VERSION 3-3
IS-800CA (IS-1400CA) ROM VERSION # 3-3

3. SCHEDULE Screen 3-3
CURRENT and TIME Setting Screen 3-3
SCHEDULE # 3-4
TIME 3-4
WELD (1, 2, 3) 3-5
UP (1, 2, 3) 3-5
DOWN (1, 2, 3) 3-5
WELD ON/OFF 3-8
CTRL 3-8
HEAT 3-10
UF (UP SLOPE FIRST) 3-10
DL (DOWN SLOPE LAST) 3-10
NEXT 3-10

PULSATION and transformer screen 3-10
SCHEDULE # 3-10
PULSE LIM 3-11
PULSATION / INTERVAL 1 to 3 3-11
WELD TRANS FREQ 3-11
VALVE # 3-12
CURRENT RANGE 3-12

MAX CURRENT 3-12
WELD ON/OFF 3-12
VOLT COMPENSATION 3-12
GAIN (01-09) 3-13
TURN RATIO 3-13
TRANS # 3-14
REV 3-14

4. MONITOR Screen 3-14
SCHEDULE # 3-14
TIME 3-14
CURRENT 3-14
VOLTAGE 3-15
POWER 3-15
PULSE 3-15
STEP # 3-15
STEPPER COUNT 3-15
STEP2 REPEAT 3-15
STEP RATIO 3-15
CAP CHANGE 3-16
TOTAL COUNTER 3-16

5. MONITOR SET Screen 3-18
SCHEDULE 3-18
TIME 3-18
CURRENT 3-18
VOLTAGE 3-18
POWER 3-18
PULSE 3-19

6. NG SIGNAL SELECT Screen 3-19
ERROR OUTPUT MODE 3-19
TIME-OVER / CURR-OVER / VOLT-OVER / POWER-OVER / PULSE-OVER / NO CURR / WRK ERR 3-20

7. OUTPUT SELECT Screen 3-21

8. COPY SETUP DATA Screen 3-22

9. MODE SELECT Screen 3-24
DELAY START SET 3-24
START SIGNAL MODE 3-25
END SIGNAL TIME 3-26
END SIGNAL MODE 3-27
WELD TIME 3-27
WELD1 STOP / PARITY CHECK 3-28

Page

WELD2 STOP / WELD COUNT 3-30
WELD3 STOP / COUNT RESET 3-30
FLOW SWITCH / PRG PROTECT 3-30
NEXT 3-31
STEPPER MODE 3-31
SCHEDULE 3-31
VALVE MODE 3-32
MONITOR DISP MODE 3-33
RE-WELD 3-33
COUNTER 3-34
SCAN MODE 3-35
COMM CONTROL 3-35
COMM MODE 3-36
COMM SPEED 3-36
DISPLC SENSOR STEP 3-36
REV 3-36

10. MONITOR MODE Screen 3-36
PRESET TOTAL COUNT 3-37
NO CURRENT TIME 3-40
NO CURRENT LEVEL 3-40
NO VOLTAGE LEVEL 3-40
MONITOR FIRST TIME 3-41
MONITOR SLOPE MODE 3-41
WELD STOP OFF TIME 3-41

11. STEPPER COUNT Screen 3-42
START ON STEP # 3-42
STEP MODE 3-43
VALVE # 3-44
STEP 1–9 3-45
COUNT 1–9 3-45
RP2 3-45
TD 1–9 3-45
CAP CHANGE 3-45

12. PRECHECK Screen 3-46
SCHEDULE # 3-46
PRECHECK TIME 3-46
PRECHECK HEAT 3-46
PRECHECK RESISTANCE HIGH 3-46
PRECHECK RESISTANCE LOW 3-46
PRECHECK MONITOR 3-46

13. I/O CHECK Screen 3-47
14. RESET TO DEFAULT Screen 3-48
15. PROGRAM PROTECT MODE Screen 3-48

Section III. Options Available On Advanced Models ONLY 3-50

16. FORCE SETUP & MONITOR Screen 3-50
SCHEDULE # 3-50
PROP VALVE # 3-50
STEP MODE (CONTINUE) 3-50
SQD 3-52
SQZ 3-52
WE1 3-52
CO1/WE2 3-52
CO2/WE3 3-52
HOLD 3-52
VALVE # 3-52
FORGE VALVE # 3-53
CHAINING 3-53
SUCCESSIVE 3-54
FORGE DELAY 3-54
FORGE MODE 3-54

17. DISPLACEMENT Screen 3-54
SCHEDULE # 3-55
WELD STOP INPUT 3-55
WELD STOP CONDITION 3-55
WORK DETECT LIMIT 3-55
WORK DETECT MONITOR 3-55
DISPLACEMENT LIMIT 3-56
DISPLACEMENT DELAY TIME 3-56
DISPLACEMENT MONITOR 3-56

18. PRESSURE REGULATOR Screen 3-56
FORCE CONTROL MODE 3-56
FORCE UNIT 3-57
AIR PRESSURE UNIT 3-57
AIR CYLINDER DIAMETER 3-58
MAX AIR PRESSURE 3-58
MAX FORCE 3-58
CALIBRATION CONSTANT FORCE 3-58
CALIBRATION LOW 3-58
CALIBRATION HIGH 3-58

Chapter 4. Operating Instructions

Section I: Introduction 4-1
Operator Safety 4-1

Page
Before You Start....4-1
Preparing for Operation 4-1
Section II: Operation 4-2
Starting Welding Operation 4-2
Check the Valve Sequence 4-2
Section III: Shutdown 4-4
Turn the Power Supply OFF 4-4

Chapter 5. Maintenance

Section I: Troubleshooting 5-1
When the Welding does not Start, Even if the Start Signal is present 5-5
Section II: Before You Start 5-7
IS-800CA / IS-1400CA Cleaning 5-7
IS-800CA / IS-1400CA Safety Precautions 5-7
Section III: Fuse Failure and Replacement 5-8
Power Supply 5-8
Section IV: Maintenance Procedures 5-9
Cooling Maintenance 5-9
Checking Water Hoses 5-9
Draining Water Hoses 5-9
Flushing Water Hoses and Cooling Chambers 5-9
Section V: Power Module Replacement 5-11
Remove Power Module 5-11
Cooling Water Hoses 5-11
Disconnect Wire Harness from Main Board Connectors 5-12
Remove the Power Module 5-13
Replace the Power Module 5-15
Section VI: Repair Service, Storage, Shipment 5-16
Repair Service 5-16
Preparation for Storage or Shipment 5-16

Appendix A. Technical Specifications....A-1
Appendix B. Electrical and Data Connections B-1
Appendix C. System Timing C-1
Appendix D. Wire Gauge and Circuit Breaker Selection D-1
Appendix E. Options....E-1
Appendix F. Communications F-1
Appendix G. EtherNet/IP™ Communications G-1

SAFETY PRECAUTIONS

DEATH ON CONTACT may result if personnel fail to observe the safety precautions labeled on the equipment and noted in this manual.

HIGH VOLTAGE is used in the operation of this equipment.

WHEN WELDING always wear safety glasses.

General

This instruction manual describes the operation and maintenance of the Power Supply and provides instructions relating to its SAFE use. Procedures described in this manual ***must*** be performed as detailed by QUALIFIED and TRAINED personnel.

For SAFETY, and to effectively take advantage of the full capabilities of the Power Supply, please read this instruction thoroughly ***before*** attempting to use it.

After reading this manual, retain it for future reference when any questions arise regarding the proper and SAFE operation of the Power Supply.

Operation

Procedures other than those described in this manual or not performed as prescribed in this manual, may expose personnel to **electrical shock** or **death**.

When operating any welder, ***always*** wear appropriate personal protective gear.

Maintenance/Service

Before performing any maintenance on the Inverter Power Supply, read *Chapter 5, Maintenance* thoroughly. Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.

Do ***not*** modify the Power Supply without prior written approval from AMADA WELD TECH.

Before using this equipment, read the **SAFETY PRECAUTIONS** carefully to understand the correct usage of the equipment.

- These precautions are given for safe use of the Inverter Power Supply and for prevention of injury to operators or others.
- Be sure to read each of the instructions, as they are all important for safe operation.
- The meanings of the words and symbols are as follows:

⚠ WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.

⚠ DANGER

Denotes operations and practices that may imminently result in serious injury or loss of life if not correctly followed.

⚠ CAUTION

Denotes operations and practices that may result in personal injury or damage to the equipment if not correctly followed.

These symbols denote **PROHIBITION.** They are warnings about actions that should ***not*** be performed because they can damage the equipment and will void the warranty.

These symbols denote actions which operators ***must*** take.

Each symbol with a triangle denotes that the contents gives notice of **DANGER, WARNING,** or **CAUTION** to the operator.

⚠ DANGER

DO NOT TOUCH THE INSIDE OF THE POWER SUPPLY UNNECESSARILY.

High Voltages are present inside the Power Supply Cabinet. Do not touch the inside of the Power Supply unnecessarily with the power turned ON. You may receive an electric shock. When inspecting the inside of the Power Supply, be sure to turn the power source OFF and push and hold the **DISCHARGE** switch until the **CHARGE** light goes OFF.

NEVER DISASSEMBLE, REPAIR, OR MODIFY THE POWER SUPPLY.

These actions can cause electric shock and fire. Do ***not*** do anything other than the maintenance described in the Operator Manual.

WARNING

Do NOT put your hands or fingers between the electrodes.
When welding, keep your hands and fingers away from the electrodes.

Do NOT touch any welded part or electrode during, or just after welding.
The welded parts and electrodes are very ***hot***. If you touch them you will be burned.

Ground the equipment.
If the equipment is not grounded, you may get an electric shock.

Use a ground fault breaker.
Use a ground fault breaker to prevent an electric shock.

Only use specified cables.
A cable with insufficient capacity or loose connections can cause electric shock or fire.

Do NOT use a damaged power cable, connecting cables, or plugs.
Do ***not*** step on, twist, or tense any cable. The power cable and connecting cables may be damaged which can cause electric shock, short circuit, or fire. If any part needs to be repaired or replaced, consult AMADA WELD TECH or your distributor.

Stop operation if any trouble occurs.
If you detect a burning smell, abnormal sounds, abnormal heat, smoke, etc., turn power OFF immediately to prevent fire or electric shock. Contact AMADA WELD TECH or your distributor for help.

People with pacemakers MUST stay away from the Power Supply.
When the Power Supply is operating, it generates a magnetic field, which adversely affects pacemakers. People who use a pacemaker must ***not*** approach the Power Supply, or walk around the welding shop while the Power Supply is operating, ***unless*** their medical doctor has deemed it safe to do so.

Wear protective gear.
Put on protective gear such as protective gloves, long sleeved jacket, and leather apron to avoid being burned.

CAUTION

Apply the specified source voltage.

Applying the ***wrong*** voltage can cause fire and electrical shock.

Keep water and water containers away from the Power Supply.

Water spilled on the Power Supply can cause a short circuit, electrical shock, or fire.

Use proper tools (wire strippers, pressure wire connectors, etc.) for terminations of the connecting cables.

Do ***not*** nick the wire conductor. Doing so can cause a short circuit, electric shock, or fire.

Install the Power Supply on a firm, level surface.

Injury may result if the Power Supply falls over or drops from an uneven surface.

Keep combustible matter away from the Power Supply.

Spatter can ignite combustible materials. If you cannot remove all combustible materials, cover them with a non-combustible material.

Do NOT cover the Power Supply with a blanket, cloth, etc.

Heat generated by the operating Power Supply may ignite a blanket or cover.

Wear ear protectors.

Loud noises can damage hearing.

Keep a fire extinguisher nearby.

Make sure there is a fire extinguisher in or near the welding shop in case of fire.

Regularly inspect and maintain the Power Supply.

Regular inspection and maintenance is essential to safe operation and long life of the equipment. If you see any damage, make necessary repairs before operation.

Disposal

Properly handle and dispose of used materials.
For the disposal of electronic waste please contact AMADA WELD TECH.

LIMITED WARRANTY

GENERAL TERMS AND CONDITIONS FOR THE SALE OF GOODS

1. Applicability.

(a) These terms and conditions of sale (these "**Terms**") are the only terms which govern the sale of the goods ("**Goods**") by Amada Weld Tech Inc. ("**Seller**") to the buyer identified in the Sales Quotation and/or Acknowledgment (as each defined below) to which these Terms are attached or incorporated by reference ("**Buyer**"). Notwithstanding anything herein to the contrary, if a written contract signed by authorized representatives of both parties is in existence covering the sale of the Goods covered hereby, the terms and conditions of said contract shall prevail to the extent they are inconsistent with these Terms.

(b) The accompanying quotation of sale (the "**Sales Quotation**") provided to Buyer, and/or sales order acknowledgement ("**Acknowledgement**") and these Terms (collectively, this "**Agreement**") comprise the entire agreement between the parties, and supersede all prior or contemporaneous understandings, agreements, negotiations, representations and warranties, and communications, both written and oral. For clarification, after the Acknowledgement is received by Buyer, the order for Goods is binding and cannot be cancelled by Buyer for any reason and the full purchase price amount set forth in the Acknowledgement shall be due and payable by Buyer to Seller pursuant to the payment schedule set forth in the Acknowledgement unless otherwise agreed to in writing by Seller. All terms and conditions contained in any prior or contemporaneous oral or written communication which are different from, or in addition to, the terms and conditions in this Agreement are hereby rejected and shall not be binding on Seller, whether or not they would materially alter this Agreement. These Terms prevail over any of Buyer's terms and conditions of purchase regardless whether or when Buyer has submitted its purchase order or such terms. Fulfillment of Buyer's order does not constitute acceptance of any of Buyer's terms and conditions and does not serve to modify or amend these Terms. Notwithstanding anything herein to the contrary, all orders for Goods must be for a minimum purchase price of $100 or such orders will be rejected by Seller.

2. Delivery.

(a) The Goods will be delivered within a reasonable time after Seller provides Buyer the Acknowledgment, subject to availability of finished Goods. Seller will endeavor to meet delivery schedules requested by Buyer, but in no event shall Seller incur any liability, consequential or otherwise, for any delays or failure to deliver as a result of ceasing to manufacture any product or any Force Majeure Event. Delivery schedules set forth in the Acknowledgment are Seller's good faith estimate on the basis of current schedules. In no event shall Seller be liable for special or consequential damages resulting from failure to meet requested delivery schedules.

(b) Unless otherwise agreed in writing by the parties in the Acknowledgement, Seller shall deliver the Goods to the seller's plant in Monrovia, CA, USA (the "**Shipping Point**") using Seller's standard methods for packaging and shipping such Goods. Buyer shall take delivery of the Goods within three (3) days of Seller's written notice that the Goods have been delivered to the Shipping Point. Buyer shall be responsible for all loading costs (including freight and insurance costs) and provide equipment and labor reasonably suited for receipt of the Goods at the Shipping Point. Seller shall not be liable for any delays, loss or damage in transit.

(c) Seller may, in its sole discretion, without liability or penalty, make partial shipments of Goods to Buyer, if applicable. Each shipment will constitute a separate sale, and Buyer shall pay for the units shipped whether such shipment is in whole or partial fulfillment of Buyer's purchase order.

(d) If for any reason Buyer fails to accept delivery of any of the Goods on the date fixed pursuant to Seller's notice that the Goods have been delivered at the Shipping Point, or if Seller is unable to deliver the Goods at the Shipping Point on such date because Buyer has not provided appropriate instructions, documents, licenses or authorizations: (i) risk of loss to the Goods shall pass to Buyer; (ii) the Goods shall be deemed to have been delivered; and (iii) Seller, at its option, may store the Goods until Buyer picks them up, whereupon Buyer shall be liable for all related costs and expenses (including, without limitation, storage and insurance).

3. Non-delivery.

(a) The quantity of any installment of Goods as recorded by Seller on dispatch from Seller's place of business is conclusive evidence of the quantity received by Buyer on delivery unless Buyer can provide conclusive evidence proving the contrary.

(b) Seller shall not be liable for any non-delivery of Goods (even if caused by Seller's negligence) unless Buyer gives written notice to Seller of the non-delivery within three (3) days of the date when the Goods would in the ordinary course of events have been received.

(c) Any liability of Seller for non-delivery of the Goods shall be limited to (in Seller's sole discretion) replacing the Goods within a reasonable time or adjusting the invoice respecting such Goods to reflect the actual quantity delivered.

4. Shipping Terms. Unless indicated otherwise in the Acknowledgment, Delivery shall be made EXW (Incoterms 2010), Shipping Point, including without limitation, freight and insurance costs. If no delivery terms are specified on the Acknowledgement, the method of shipping will be in the sole discretion of Seller. Unless directed in writing otherwise by Buyer, full invoice value will be declared for all shipments.

5. Title and Risk of Loss. Title and risk of loss passes to Buyer upon delivery of the Goods at the Shipping Point. As collateral security for the payment of the purchase price of the Goods, Buyer hereby grants to Seller a lien on and security interest in and to all of the right, title and interest of Buyer in, to and under the Goods, wherever located, and whether now existing or hereafter arising or acquired from time to time, and in all accessions thereto and replacements or modifications thereof, as well as all proceeds (including insurance proceeds) of the foregoing. The security interest granted under this provision constitutes a purchase money security interest under the California Commercial Code.

6. Amendment and Modification. These Terms may only be amended or modified in a writing which specifically states that it amends these Terms and is signed by an authorized representative of each party.

7. Inspection and Rejection of Nonconforming Goods.

(a) Buyer shall inspect the Goods within two (2) days of receipt ("**Inspection Period**"). Buyer will be deemed to have accepted the Goods unless it notifies Seller in writing of any Nonconforming Goods during the Inspection Period and furnishes such written evidence or other documentation as required by Seller. "**Nonconforming Goods**" means only the following: (i) product shipped is different than identified in Buyer's Acknowledgement; or (ii) product's label or packaging incorrectly identifies its contents. Notwithstanding the foregoing, for shipped Goods that require field installation, the "re-verification" terms in the Acknowledgement shall apply and for custom installations, the inspection and verification shall take place at Buyer's site immediately after the installation is completed.

(b) Seller will only accept Nonconforming Goods that are returned under Seller's Return Material Authorization procedures then in effect ("**RMA**"). Buyer shall obtain a RMA number from Seller prior to returning any Nonconforming Goods and return the Nonconforming Goods prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 or to such other location as designated in writing by Seller for the examination to take place there. If Seller reasonably verifies Buyer's claim that the Goods are Nonconforming Goods and that the nonconformance did not developed by use from Buyer, Seller shall, in its sole discretion, (i) replace such Nonconforming Goods with conforming Goods, or (ii) credit or refund the Price for such Nonconforming Goods pursuant to the terms set forth herein. Notwithstanding the foregoing, the only remedy for Nonconforming Goods that are custom systems is repair (not refund or replacement). No returns for Nonconforming Goods are allowed after thirty (30) days from the original shipping date.

(c) Buyer acknowledges and agrees that the remedies set forth in Section 7(a) are Buyer's exclusive remedies for the delivery of Nonconforming Goods. Except as provided under Section 7(a) and Section 14, all sales of Goods to Buyer are made on a one-way basis and Buyer has no right to return Goods purchased under this Agreement to Seller.

8. Price.

(a) Buyer shall purchase the Goods from Seller at the prices (the "**Prices**") set forth in Seller's published catalogue literature in force as of the date of the Sales Quotation. However, the Prices shown in such catalogue literature or any other publication are subject to change without notice. Unless specifically stated to the contrary in the Sales Quotation, quoted Prices and discounts are firm for thirty (30) days from the date of the Sales Quotation. Unless otherwise stated, prices are quoted EXW (Incoterms 2010), Shipping Point. Unless otherwise stated in the Acknowledgement, if the Prices should be increased by Seller before delivery of the Goods to a carrier for shipment to Buyer, then these Terms shall be construed as if the increased prices were originally inserted herein, and Buyer shall be billed by Seller on the basis of such increased prices.

(b) All Prices are exclusive of all sales, use and excise taxes, and any other similar taxes, duties and charges of any kind imposed by any governmental authority on any amounts payable by Buyer. Buyer shall be responsible for all such charges, costs and taxes (present or future); provided, that, Buyer shall not be responsible for any taxes imposed on, or with respect to, Seller's income, revenues, gross receipts, personnel or real or personal property or other assets.

9. Payment Terms.

(a) Unless otherwise provided in the Acknowledgement, if Buyer has approved credit with Seller, Buyer shall pay all invoiced amounts due to Seller within thirty (30) days from the date of Seller's invoice. If Seller does not have Buyer's financial information and has not provided pre-approved credit terms for Buyer, the payment must be made in cash with order or C.O.D. in US dollars. If Buyer has approved credit terms, the payment may be made by cash with order, wire transfer of immediately available funds, or check in US dollars. Certain products require a down payment. Any payment terms other than set forth above will be identified in the Acknowledgement. Notwithstanding anything herein to the contrary, all prepaid deposits and down payments are non-refundable. If a deposit is not received when due, Seller reserves the right to postpone manufacturing of Goods until payment is received. Seller will not be responsible for shipment delays due to deposit payment delays.

(b) In Seller's sole discretion, Seller may access Buyer interest on all late payments at the lesser of the rate of 1.5% per month or the highest rate permissible under applicable law, calculated daily and compounded monthly. Buyer shall reimburse Seller for all costs incurred in collecting any late payments, including, without limitation, attorneys' fees. In addition to all other remedies available under these Terms or at law (which Seller does not waive by the exercise of any rights hereunder), Seller shall be entitled to suspend the delivery of any Goods if Buyer fails to pay any amounts when due hereunder and such failure continues for ten (10) days following written notice thereof.

(c) Buyer shall not withhold payment of any amounts due and payable by reason of any set-off of any claim or dispute with Seller, whether relating to Seller's breach, bankruptcy or otherwise.

10. Intellectual Property; Software License.

(a) To the extent that any Goods provided under this Agreement contains software, whether pre-installed, embedded, in read only memory, or found on any other media or other form ("**Software**"), such Software and accompanying documentation are licensed to Buyer, not sold and shall remain the sole and exclusive property of Seller or third party licensors of Seller. Seller grants Buyer a non-exclusive license to use the Software solely as provided in and in connection with the use of the Goods in which such Software is contained and in accordance with any applicable user documentation provided with such Goods and subject to the provisions of this Agreement. Certain of Seller's Goods may include third party software such as computer operating systems. Licenses to such third party software are subject to the terms and conditions of any applicable third party software license agreements. Unless identified in the Acknowledgement, no license is granted by Seller with respect to such third party software products that may be provided with the Goods (if any). Seller makes no warranties regarding any third party software that may accompany the Goods or otherwise and such software is explicitly included in the definition of Third Party Products below.

(b) Buyer shall not copy, modify, or disassemble, or permit others to copy, modify, or disassemble, the Software, nor may Buyer modify, adapt, translate, reverse assemble, decompile, or otherwise attempt to derive source code from the Software. Buyer shall not transfer possession of the Software except as part of, or with, the Goods, and each such transfer shall be subject to the restrictions contained herein. Buyer may not sublicense, rent, loan, assign or otherwise transfer the Software or documentation, and Buyer shall retain on all copies of the Software and documentation all copyright and other

proprietary notices or legends appearing therein or thereon. Seller may terminate this license upon written notice for any violation of any of the terms of this license or any material breach of any provision of this Agreement. Buyer shall immediately discontinue use of the Software upon any termination of this license or Agreement. This license shall terminate upon any termination of the Agreement.

(c) All patents, trademarks, copyrights or other intellectual property rights embodied in the Goods, including without limitation the Software, are owned by Seller and its licensors. Seller and its licensors retain all right, title and interest in such intellectual property rights. Except as expressly set forth herein, no license rights or ownership in or to any of the foregoing is granted or transferred hereunder, either directly or by implication. ALL RIGHTS RESERVED.

(d) If Buyer is the United States Government or any agency thereof, each of the components of the Software and user documentation are a "commercial item," and "computer software" as those terms are defined at 48 C.F.R. 2.101, consisting of "commercial computer software" and "commercial computer software documentation," as such terms are used in 48 C.F.R. 12.212. Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4, all United States government Buyers acquire only those rights in the Software and user documentation that are specified in this Agreement.

11. Installation and Other Services. Seller shall provide installation services ("**Installation Services**") to Buyer if set forth in the Acknowledgment. If Installation Services are provided for in the Acknowledgement, Buyer will prepare the location for the installation consistent with Buyer's written specifications and Buyer will install necessary system cable and assemble any necessary equipment or hardware not provided by Seller, unless agreed otherwise in writing by the parties. For Goods that will be operated on or in connection with Buyer supplied hardware or software, Buyer is responsible for ensuring that its hardware and software conform with Seller minimum hardware and software requirements as made available to Buyer. Seller shall provide other field services, such as maintenance visits and field repairs (the "**Other Services**" and together with the Installation Services, the "**Services**") if set forth in the Acknowledgement.

12. Limited Warranty.

(a) Subject to the exceptions and upon the conditions set forth herein, Seller warrants to Buyer that for a period of one (1) year from the date of shipment ("**Warranty Period**"), that such Goods will be free from material defects in material and workmanship.

(b) Notwithstanding the foregoing and anything herein to the contrary, the warranty set forth in this Section 12 shall be superseded and replaced in its entirety with the warranty set forth on **Exhibit A** hereto if the Goods being purchased are specialty products, which include, without limitation, laser products, fiber markers, custom systems, workstations, Seller-installed products, non-catalogue products and other custom-made items (each a "**Specialty Product**").

(c) **EXCEPT FOR THE WARRANTY SET FORTH IN SECTION 12(A), SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.**

(d) Products manufactured by a third party and third party software ("**Third Party Product**") may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 12(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer's sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party's warranty.

(e) Seller shall not be liable for a breach of the warranty set forth in Section 12(a) unless: (i) Buyer gives written notice of the defect, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods; (iii) Buyer (if requested to do so by Seller) returns such Goods (prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016or to such other location as designated in writing by Seller) to Seller pursuant to Seller's RMA procedures and Buyer obtains a RMA number from Seller prior to returning such Goods for the examination to take place; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective and that the defect developed under normal and proper use.

(f) Seller shall not be liable for a breach of the warranty set forth in Section 12(a) if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller's oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller's own service personnel, or an authorized representative's personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

(g) All expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

(h) Subject to Section 12(e) and Section 12(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate, provided that, if Seller so requests, Buyer shall, at Buyer's expense, return such Goods to Seller.

(i) **THE REMEDIES SET FORTH IN SECTION 12(H) SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN SECTION 12(A).** Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

13. Limitation of Liability.

(a) **IN NO EVENT SHALL SELLER BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES, LOST PROFITS OR REVENUES OR DIMINUTION IN VALUE, LOSS OF INFORMATION OR DATA, OR PERSONAL INJURY OR DEATH ARISING IN ANY WAY OUT OF THE MANUFACTURE, SALE, USE, OR INABILITY TO USE ANY GOODS, SOFTWARE OR SERVICE, ORARISING OUT OF OR RELATING TO ANY BREACH OF THESE TERMS, WHETHER OR NOT THE POSSIBILITY OF SUCH DAMAGES HAS BEEN DISCLOSED IN ADVANCE BY BUYER OR COULD HAVE BEEN**

REASONABLY FORESEEN BY BUYER, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE.

(b) **IN NO EVENT SHALL SELLER'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THIS AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE TOTAL OF THE AMOUNTS PAID TO SELLER FOR THE GOODS SOLD HEREUNDER.**

(c) **ALL WARRANTIES SET FORTH HEREIN, DIRECT OR IMPLIED, ARE VOIDED IF THE INITIAL INSTALLATION AND START-UP OF THE SUBJECT GOOD IS NOT SUPERVISED BY AN AUTHORIZED REPRESENTATIVE OF SELLER. AFTER INSTALLATION, ANY RE-ALIGNMENT, RE-CLEANING, OR RE-CALIBRATION, PROVIDED THEY ARE NOT RELATED TO A PROVEN DEFECT IN MATERIALS OR WORKMANSHIP, SHALL BE PERFORMED BY AN AUTHORIZED REPRESENTATIVE OF SELLERAT THE CURRENT SERVICE RATES.**

(d) **WHERE GOODS ARE SUBJECT TO A MOVE TO ANOTHER LOCATION AFTER THE ORIGINAL INSTALLATION HAS BEEN MADE, THE WARRANTY MAY BE MAINTAINED ONLY IF SUPERVISED BY AN AUTHORIZED REPRESENTATIVE OF SELLER. SELLER, FOR A SERVICE CHARGE, WILL ARRANGE FOR AND SUPERVISE THE DISCONNECTION, TRANSPORTATION, REINSTALLATION AND START-UP OF THE EQUIPMENT. CLAIMS FOR DAMAGE IN SHIPMENT ARE THE RESPONSIBILITY OF BUYER AND SHALL BE FILED PROMPTLY WITH THE TRANSPORTATION COMPANY.**

14. Return Goods Policy. Seller's products may be returned to Seller for credit within sixty (60) days of shipment subject to the following conditions.

(a) In order to return products for credit, Buyer must obtain a RMA number from Seller. Upon receipt, it must be executed by an authorized person and then returned with the Goods. Goods returned to Seller without a RMA will be returned at Buyer's expense.

(b) Goods are to be returned to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 with Freight Prepaid. Seller will not accept collect shipments.

(c) Restocking fees will be assessed in accordance with the following schedules: (i) Goods returned within the first thirty (30) days from shipment date will be restocked less twenty percent (20%) of the amount billed on the original invoice. (ii) Goods returned over thirty (30) days of shipment but less than sixty (60) days will be restocked less thirty percent (30%) of the amount billed on the original invoice. (iii) No returns are allowed after sixty (60) days from the original shipping date.

(d) The restocking fees set forth above are the minimum fees. If a returned Good requires rework to restore it to a saleable condition, further charges will be assessed. Seller's quality assurance department will document the condition of the Goods when received by Seller and report their findings to Buyer.

(e) **Notwithstanding the foregoing provisions of this Section 14, the following Goods cannot be returned, are not eligible for any credit and cannot be restocked: (i) custom or modified products and (ii) any expendable product(s) that have been used.**

15. Compliance with Law and Indemnification. Buyer shall comply with all applicable laws, regulations and ordinances. Buyer shall maintain in effect all the licenses, permissions, authorizations, consents and permits that it needs to carry out its obligations under this Agreement. Buyer shall comply with all export and import laws of all countries involved in the sale of the Goods under this Agreement or any resale of the Goods by Buyer. Goods, Services and technical data delivered by Seller shall be subject to U.S. export controls. Buyer shall, and shall cause its customers to, obtain all licenses, permits and approvals required by any government and shall comply with all applicable laws, rules, policies and procedures of the applicable government and other competent authorities. Buyer will indemnify and hold Seller harmless for any violation or alleged violation by Buyer of such laws, rules, policies or procedures. Buyer shall not transmit, export or re-export, directly or indirectly, separately or as part of any system, the Goods or any technical data (including processes and Services) received from Seller, without first obtaining any license required by the applicable government, including without limitation, the U.S. government. Buyer also certifies that none of the Goods or technical data supplied by Seller under this Agreement will be sold or otherwise transferred to, or made available for use by or for, any entity that is engaged in the design, development, production or use of nuclear, biological or chemical weapons or missile technology. No Buyer information will be deemed "technical data" unless Buyer specifically identifies it to Seller as such. Buyer assumes all responsibility for shipments of Goods requiring any government import clearance. Seller may terminate this Agreement if any governmental authority imposes antidumping or countervailing duties or any other penalties on Goods. For all international shipments, Seller requires that all required Export Control documentations, including Form BIS-711 Statement by Ultimate Consignee and Purchases, are submitted by Buyer along with the purchase order. Seller reserves the right to postpone shipment until all documentations are completed and submitted to Seller. Seller will not be responsible for shipment delays due to non-compliance by Buyer of the foregoing two sentences.

16. Termination. In addition to any remedies that may be provided under these Terms, Seller may terminate this Agreement with immediate effect upon written notice to Buyer, if Buyer: (i) fails to pay any amount when due under this Agreement and such failure continues for ten (10) days after Buyer's receipt of written notice of nonpayment; (ii) has not otherwise performed or complied with any of these Terms, in whole or in part; or (iii) becomes insolvent, files a petition for bankruptcy or commences or has commenced against it proceedings relating to bankruptcy, receivership, reorganization or assignment for the benefit of creditors.

17. Waiver. No waiver by Seller of any of the provisions of this Agreement is effective unless explicitly set forth in writing and signed by Seller. No failure to exercise, or delay in exercising, any rights, remedy, power or privilege arising from this Agreement operates or may be construed as a waiver thereof. No single or partial exercise of any right, remedy, power or privilege hereunder precludes any other or further exercise thereof or the exercise of any other right, remedy, power or privilege.

18. Confidential Information. All non-public, confidential or proprietary information of Seller, including, but not limited to, specifications, samples, patterns, designs, plans, drawings, documents, data, business operations, customer lists, pricing, discounts or rebates, disclosed by Seller to Buyer, whether disclosed orally or disclosed or accessed in written, electronic or other form or media, and whether or not marked, designated or otherwise identified as "confidential," in connection with this Agreement is confidential, solely for the use of performing this Agreement and may not be disclosed or copied unless authorized in advance by Seller in writing. Upon Seller's request, Buyer shall promptly return all documents and other materials received from Seller. Seller shall be entitled to injunctive relief for any violation of this Section 18. This Section 18 does not apply to information that is: (a) in the public domain through no fault of Buyer; (b) known to Buyer at the time of disclosure without restriction as evidenced by its records; or (c) rightfully obtained by Buyer on a non-confidential basis from a third party.

19. Force Majeure. Seller shall not be liable or responsible to Buyer, nor be deemed to have defaulted or breached this Agreement, for any failure or delay in fulfilling or performing any term of this Agreement when and to the extent such failure or delay is caused by or results from acts or circumstances beyond the reasonable control of Seller including, without limitation, acts of God, flood, fire, earthquake, explosion, governmental actions, war, invasion or hostilities (whether war is declared or not), terrorist threats or acts, riot, or other civil unrest, national emergency, revolution, insurrection, epidemic, lock-outs, strikes or other labor disputes (whether or not relating to either party's workforce), or restraints or delays affecting carriers or inability or delay in obtaining supplies of adequate or suitable materials, materials or telecommunication breakdown or power outage (each a "**Force Majeure Event**"), provided that, if the event in question continues for a continuous period in excess of thirty (30) days, Buyer shall be entitled to give notice in writing to Seller to terminate this Agreement.

20. Assignment. Buyer shall not assign any of its rights or delegate any of its obligations under this Agreement without the prior written consent of Seller. Any purported assignment or delegation in violation of this Section 20 is null and void. No assignment or delegation relieves Buyer of any of its obligations under this Agreement.

21. Relationship of the Parties. The relationship between the parties is that of independent contractors. Nothing contained in this Agreement shall be construed as creating any agency, partnership, joint venture or other form of joint enterprise, employment or fiduciary relationship between the parties, and neither party shall have authority to contract for or bind the other party in any manner whatsoever.

22. No Third-Party Beneficiaries. This Agreement is for the sole benefit of the parties hereto and their respective successors and permitted assigns and nothing herein, express or implied, is intended to or shall confer upon any other person or entity any legal or equitable right, benefit or remedy of any nature whatsoever under or by reason of these Terms.

23. Governing Law. All matters arising out of or relating to this Agreement is governed by and construed in accordance with the internal laws of the State of California without giving effect to any choice or conflict of law provision or rule (whether of the State of California or any other jurisdiction) that would cause the application of the laws of any jurisdiction other than those of the State of California.

24. Dispute Resolution.

(a) If Buyer is an entity formed under the laws of the United States of America, or any of its states, districts or territories ("**U.S. Law**"), then any dispute, legal suit, action or proceeding arising out of or relating to this Agreement shall be adjudicated and decided in the federal courts of the United States of America or the courts of the State of California in each case located in the City of Los Angeles and County of Los Angeles, California and each party irrevocably submits to the exclusive and personal jurisdiction of such courts in any such dispute, suit, action or proceeding.

(b) If Buyer is an entity formed under the laws of any country, state, district or territory other than U.S. Law, then the parties irrevocably agree that any dispute, legal suit, action or proceeding arising out of or relating to this Agreement shall be submitted to the International Court of Arbitration of the International Chamber of Commerce ("**ICC**") and shall be finally settled under the Rules of Arbitration of the ICC. The place and location of the arbitration shall be in Los Angeles, California, pursuant to the ICC's Rules of Arbitration and shall be finally settled in accordance with said rules. The arbitration shall be conducted before a panel of three arbitrators. Each party shall select one arbitrator and the two arbitrators so selected shall select the third arbitrator, who shall act as presiding arbitrator. Notwithstanding the foregoing, if the matter under dispute is $500,000 or less, there shall only be one arbitrator who shall be mutually selected by both parties. If the party-selected arbitrators are unable to agree upon the third arbitrator, if either party fails to select an arbitrator, or in the case that only one arbitrator is required and the parties are unable to agree, then the International Court of Arbitration shall choose the arbitrator. The language to be used in the arbitral proceeding shall be English. The arbitrator(s) shall have no authority to issue an award that is contrary to the express terms of this Agreement or the laws of the State of California or applicable US Federal Law, and the award may be vacated or corrected on appeal to a court of competent jurisdiction for any such error. The arbitrator(s) shall be specifically empowered to allocate between the parties the costs of arbitration, as well as reasonable attorneys' fees and costs, in such equitable manner as the arbitrator(s) may determine. The arbitrator(s) shall have the authority to determine issues of arbitrability and to award compensatory damages, but they shall not have authority to award punitive or exemplary damages. Judgment upon the award so rendered may be entered in any court having jurisdiction or application may be made to such court for judicial acceptance of any award and an order of enforcement, as the case may be. In no event shall a demand for arbitration be made after the date when institution of a legal or equitable proceeding based upon such claim, dispute or other matter in question would be barred by the applicable statute of limitations. Notwithstanding the foregoing, either party shall have the right, without waiving any right or remedy available to such party under this Agreement or otherwise, to seek and obtain from any court of competent jurisdiction any interim or provisional relief that is necessary or desirable to protect the rights or property of such party, pending the selection of the arbitrator(s) hereunder or pending the arbitrator(s)' determination of any dispute, controversy or claim hereunder.

25. Notices. All notices, request, consents, claims, demands, waivers and other communications hereunder (each, a "**Notice**") shall be in writing and addressed to the parties at the addresses set forth on the face of the Acknowledgement or to such other address that may be designated by the receiving party in writing. All Notices shall be delivered by personal delivery, nationally recognized overnight courier (with all fees pre-paid), facsimile (with confirmation of transmission) or certified or registered mail (in each case, return receipt requested, postage prepaid). Except as otherwise provided in this Agreement, a Notice is effective only (a) upon receipt of the receiving party, upon confirmation of delivery by nationally recognized overnight courier or upon forty-eight (48) hours after being sent by certified or registered mail (as applicable), and (b) if the party giving the Notice has complied with the requirements of this Section 25.

26. Severability. If any term or provision of this Agreement is invalid, illegal or unenforceable in any jurisdiction, such invalidity, illegality or unenforceability shall not affect any other term or provision of this Agreement or invalidate or render unenforceable such term or provision in any other jurisdiction.

27. Survival. Provisions of these Terms which by their nature should apply beyond their terms will remain in force after any termination or expiration of this Order including, but not limited to, the following provisions: Compliance with Laws, Confidentiality, Governing Law, Dispute Resolution, Survival, and the restrictions on Software in Sections 10(b), (c) and (d).

CHAPTER 1
SYSTEM DESCRIPTION
Section I: Features

Basic and Advanced Units

The AMADA WELD TECH IS-800CA/1400CA is an inverter-type power supply specially designed for spot welding and fusing. The IS-800CA provides 800 amps of primary current, while the IS-1400CA provides 1400 amps of primary current.

The IS-800CA/1400CA can be ordered as a **Basic** (IS-800CA/1400CA-Ax-xx) or **Advanced** (IS-800CA/1400CA-Bx-xx) unit. The feature differences are highlighted below and throughout the manual. For the rest of this manual, the AMADA WELD TECH IS-800CA/1400CA will simply be referred to as ***the Power Supply***, unless a feature or procedure unique to a specific model is described.

You program and monitor Power Supply operation by using the external MA-660A Program Unit which is sold separately. This Program Unit is commonly referred to as "the Pendant." For the rest of this manual, the MA-660A will simply be referred to as ***the Pendant.***

- The power supply accepts 3-phase voltage from 380 VAC or 480 VAC (model dependent).
- Welding-current monitoring function for judgment of weld quality.
- Six control systems:
  - Primary constant-current effective value control.
  - Secondary constant-current effective value control.
  - Secondary constant-power effective value control.
  - Primary constant-current peak value control.
  - Secondary constant-voltage effective value control, and Constant-phase control for stable weld quality. The control method can be set for WELD1 to WELD3, respectively.
  - Pulse and upslope (downslope) can be set for WELD1 to WELD3, respectively.
- The welding frequency can be adjusted from 600 – 3000 Hz in 100 Hz steps in each schedule. Higher frequencies aid in the welding of finer applications. Please match the frequency of the welder to the transformer.
- Comes equipped with a current-shutoff function, which shuts off current in response to external input (e.g., displacement of the electrode) for WELD1 to WELD3 respectively, ensuring stable fusing.
- Use of an inverter allows for high power factor and stable power conditions.
- Easy setting of a variety of items through the menu selection system.
- Applicable to inverter transformers manufactured by various companies by changing the frequency (600 Hz to 3,000 Hz in units of 100 Hz).

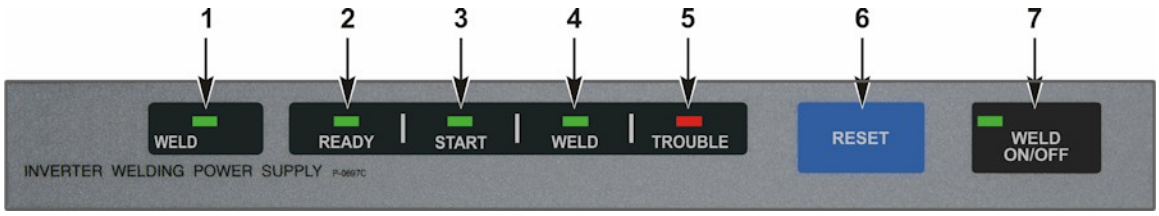
- Seven protective functions for maximum ease of operation:
  - No-current / no-voltage
  - Over current
  - Temperature
  - Self diagnostics
  - Grounding error
  - Load short error
  - Phase error
- Circuit breaker with rotary handle is included (IS-800CA: 250 amps, IS-1400CA: 400 amps).
- 120 VAC, 150 VA valve transformer standard, 250 VA optional.
- 24 VDC valve voltage: 2 amps (optional), 5 amps (optional).
- Output contactors optional.
- CE compliance optional.
- RS-232 communications standard, RS-485 optional.

Advanced Models Only

- **IS-800CA/1400CA**: The analog output terminal (voltage output proportional to force) for electro-pneumatic proportional valve and the analog input terminal (voltage input proportional to force) for force measurement have two channels, respectively.
- **IS-800CA/1400CA**: Welding can be stopped at the set displacement by connecting the displacement gauge and measuring the displacement produced in fusing.

Section II: System Components

Front Panel



1. WELD POWER Lamp

Indicator that lights when the power is supplied to the Power Supply.

2. READY Lamp

Indicator that lights when the system is ready to start welding. For this status to exist, the following conditions must be met:

- The **WELD ON/OFF** button must be pressed to ON (The **WELD ON/OFF** indicator is lit)
- The **WELD ON/OFF** setting on the MA-660A pendant must be ON, and
- External **WELD ON/OFF** signal must be ON.

3. START Lamp

Indicator that lights when the Start signal is present.

4. WELD Lamp

Indicator that lights when the weld current is flowing.

5. TROUBLE Lamp

Indicator that lights when trouble is detected. The Pendant will also make a beeping sound. When this condition occurs, the unit operation is interrupted.

6. RESET Pushbutton Switch

This switch resets a trouble condition ***only if the trouble has been corrected***. If the cause of trouble is not removed, the operation will again be interrupted and the **TROUBLE** indicator will light again. After the RESET pushbutton switch is pressed, the START signal must be re-sent to the Power Supply for welding to begin.

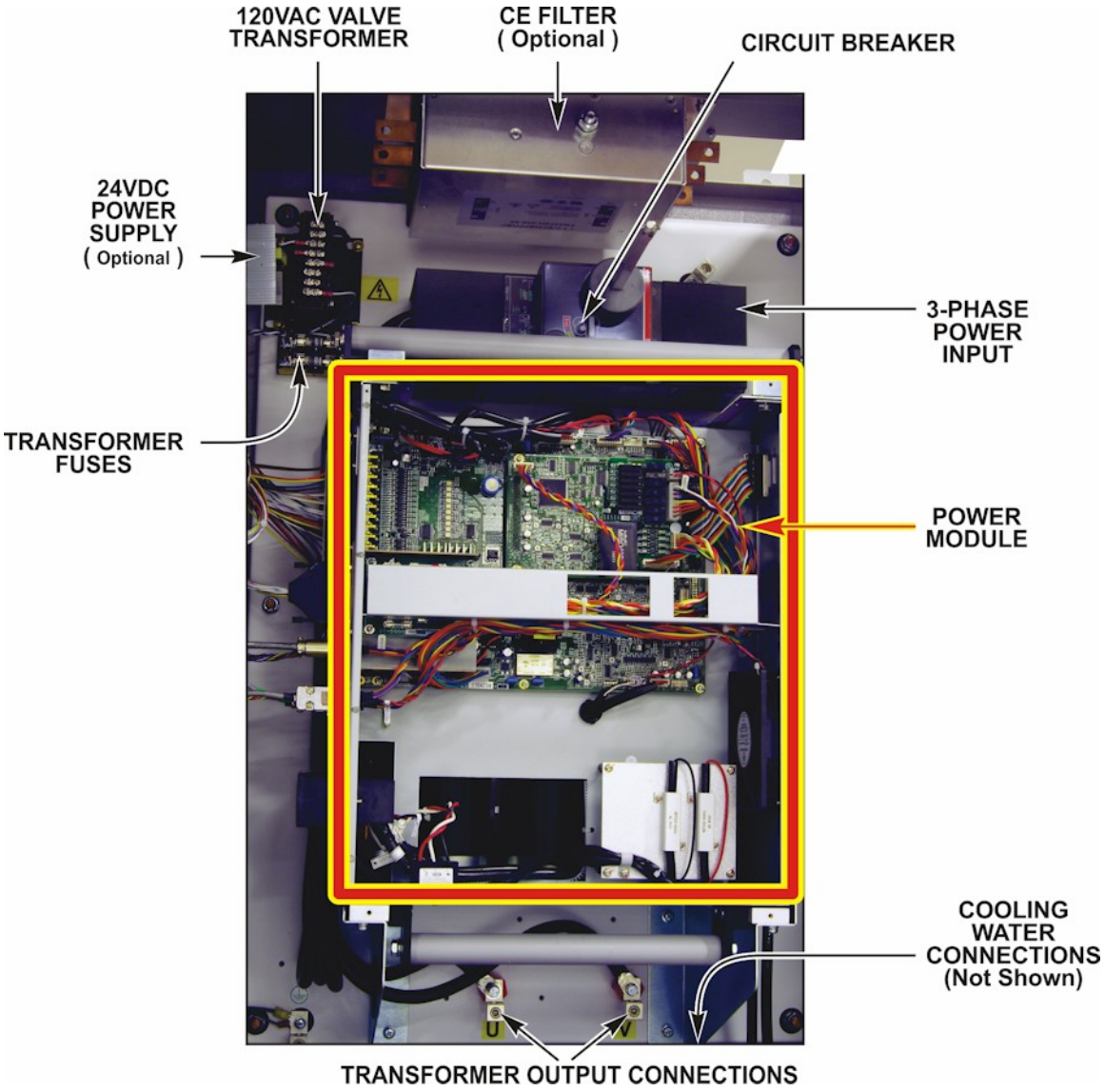
7. WELD ON/OFF Pushbutton Switch

This switch enables the unit to weld. When **ON**, the green indicator lights. When operating, the switch needs to be held until the green LED lights (or goes out). This is one of three conditions required to place the unit in the Ready condition; see "READY," above.

Internal Components

DANGER
Do ***not*** touch the inside of the ***Power Supply*** for at least 20 minutes after power down, since you may get a severe electric shock.

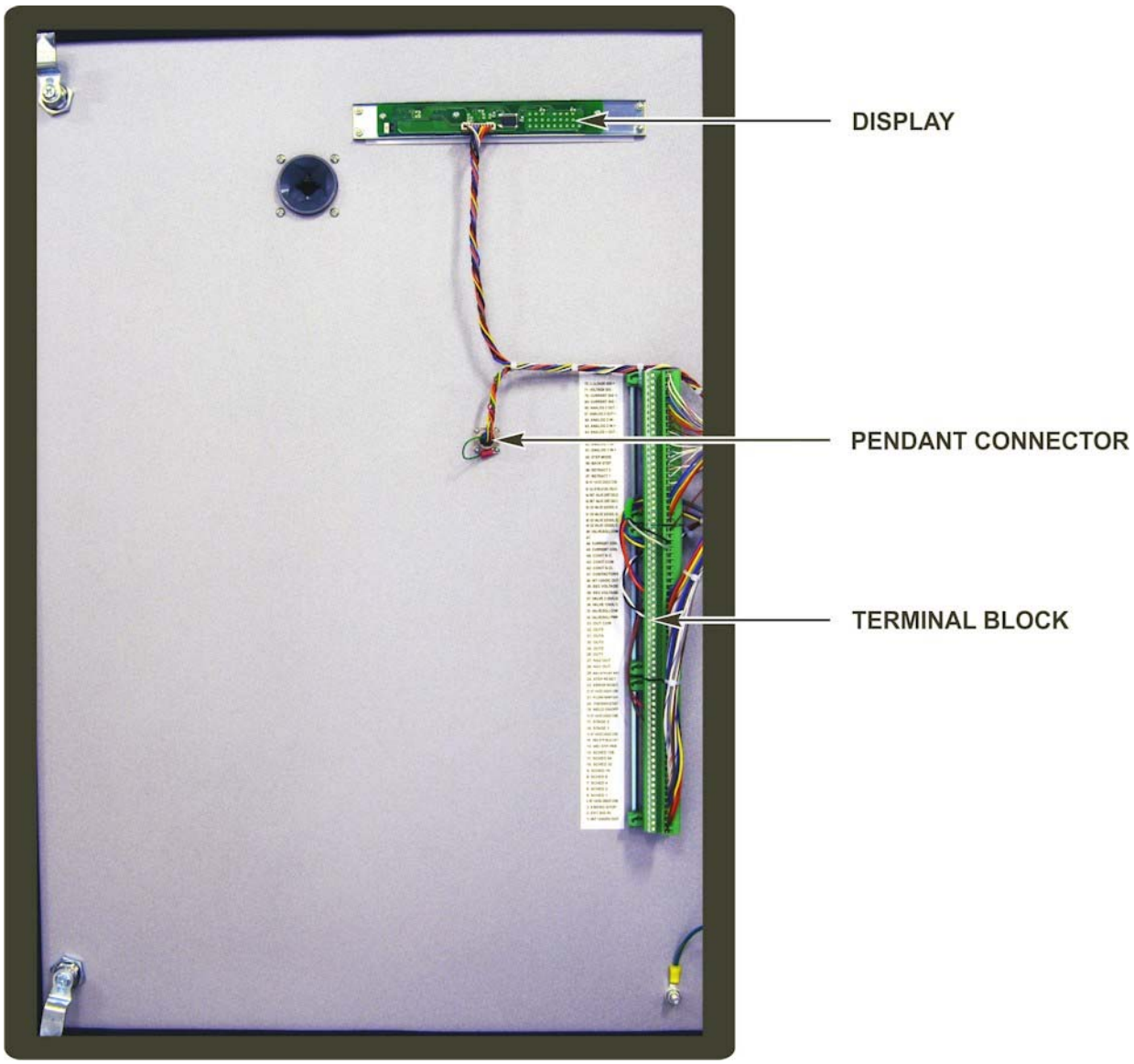
NOTE: There are minor differences between the size and connector locations between the IS-800CA and the IS-1400CA, but in all other respects the internal components of the two models are identical.



Connecting Terminal Strip for External Input / Output Signals

Used to input start signals and output trouble signals.

NOTE: The IS-800CA **Basic** model is shown here. The IS-800CA **Advanced** has more I/O connections

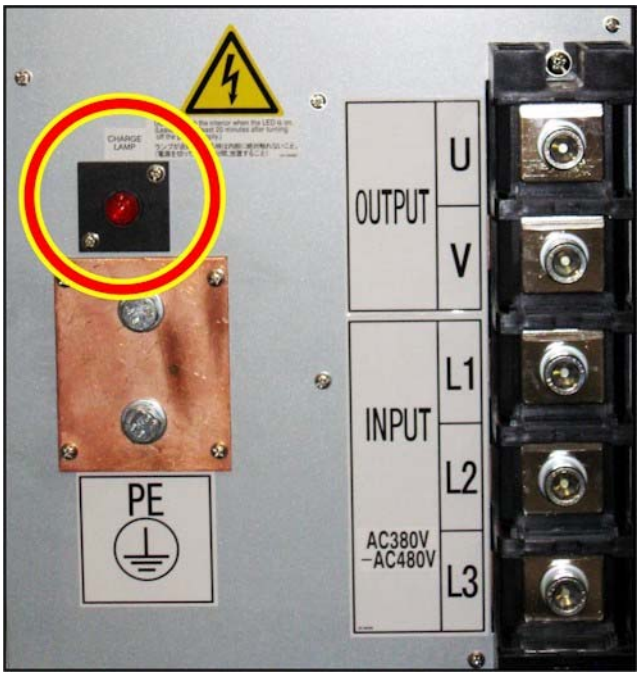


CHARGE INDICATOR Lamp

DANGER
Lethal voltages are present when the capacitors are charged. Do ***not*** touch the interior of the Power Supply when the LED is ON. ***Leave it alone for at least 20 minutes after turning the Power Supply OFF.***

This lamp is located on the panel next to the transformer **INPUT/OUTPUT** terminals on the Power Module.

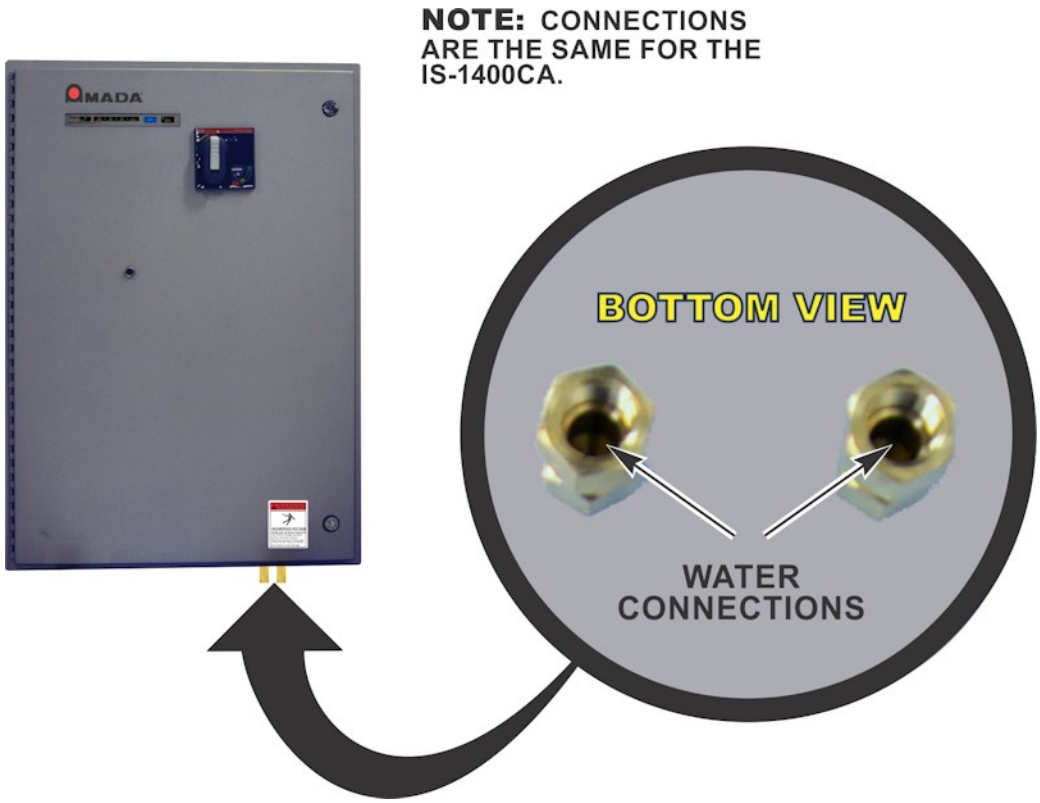
The charge level of this electrolytic capacitor is indicated by the brightness of the **CHARGE INDICATOR** lamp. The more the capacitor is charged, the brighter the **CHARGE INDICATOR** lamp will be.



External Connections

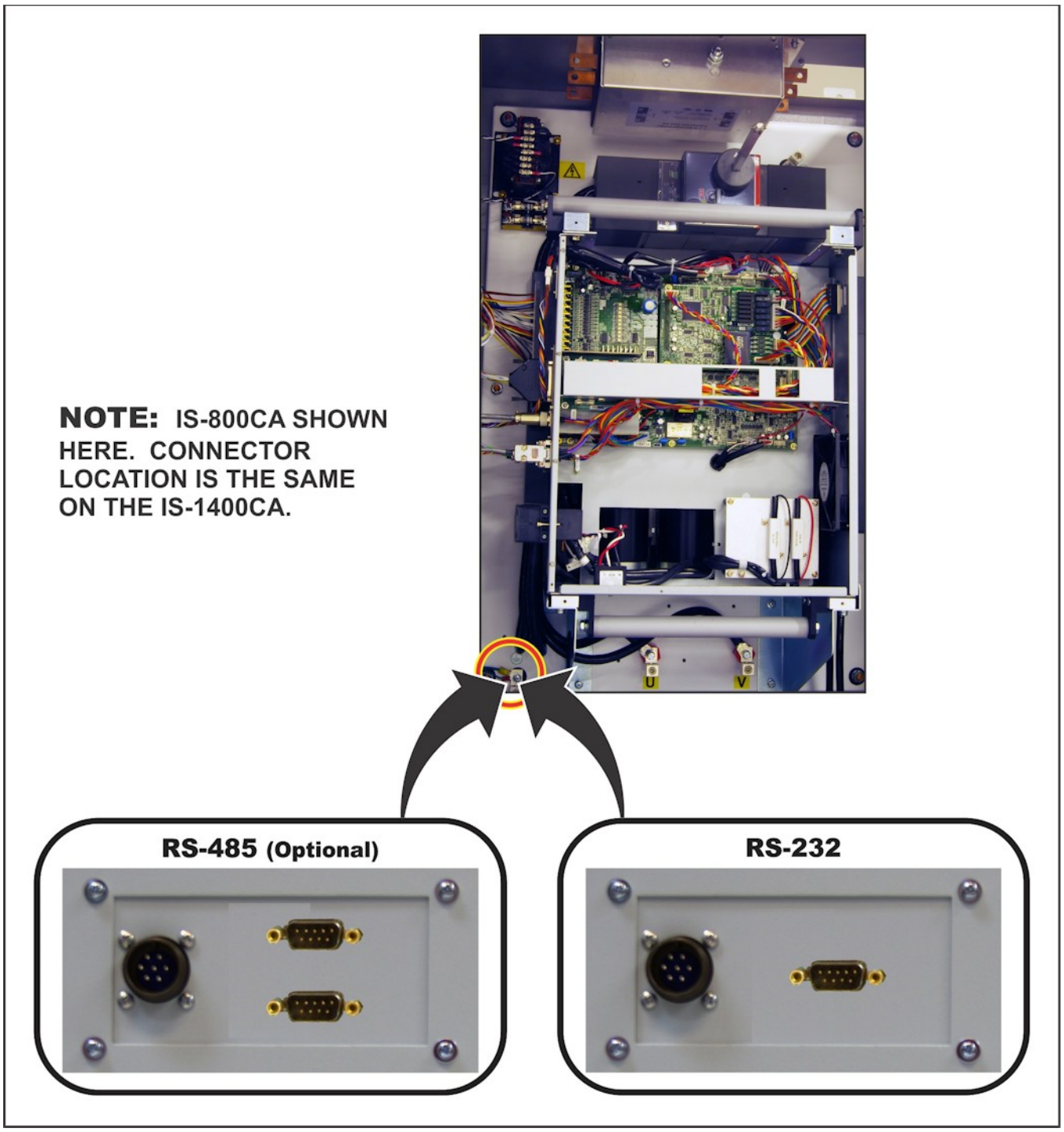
Cooling Water Pipe Connectors

Used for the supply (input) and drain (output) of cooling water, which cools the inside of the enclosure and power supply unit.



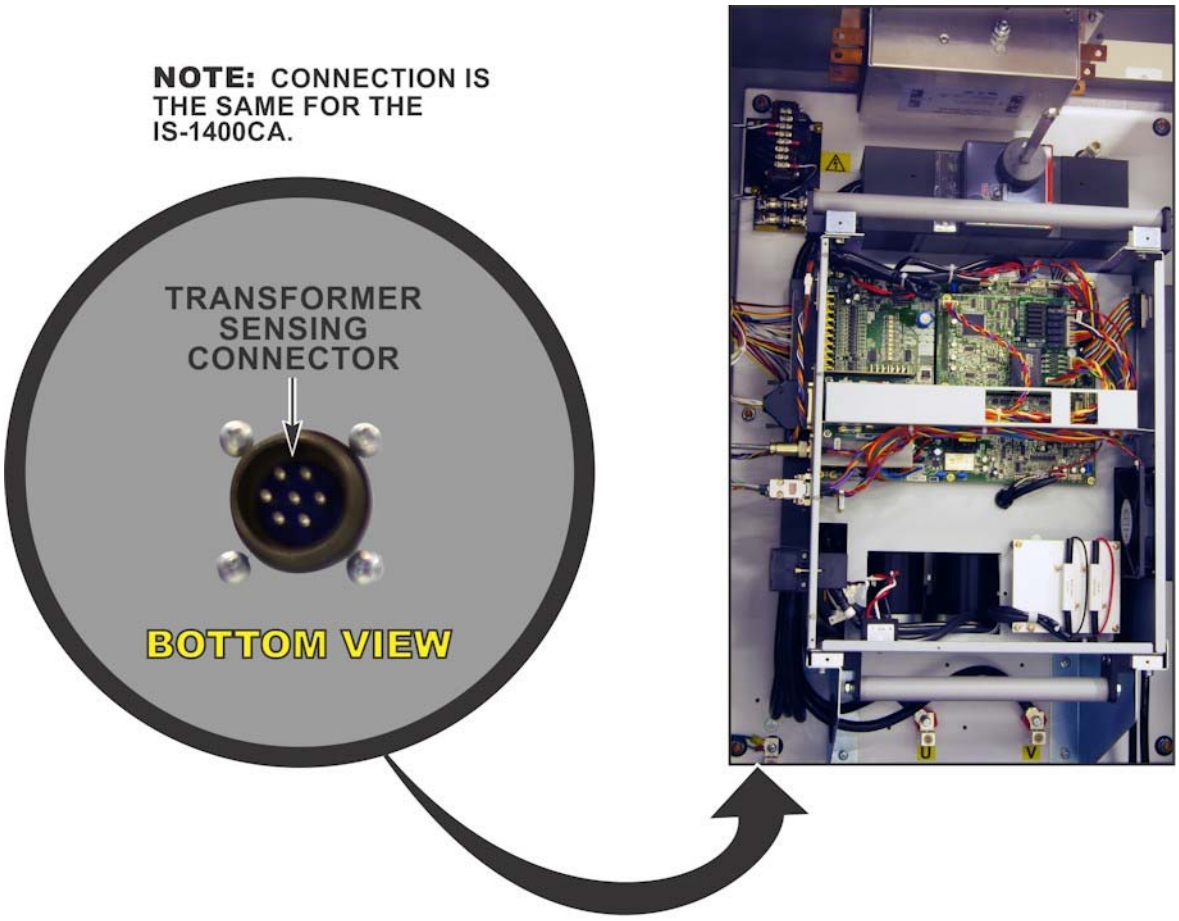
RS-485/RS-232C Connector

For external communication see *Appendix F, Communications*.



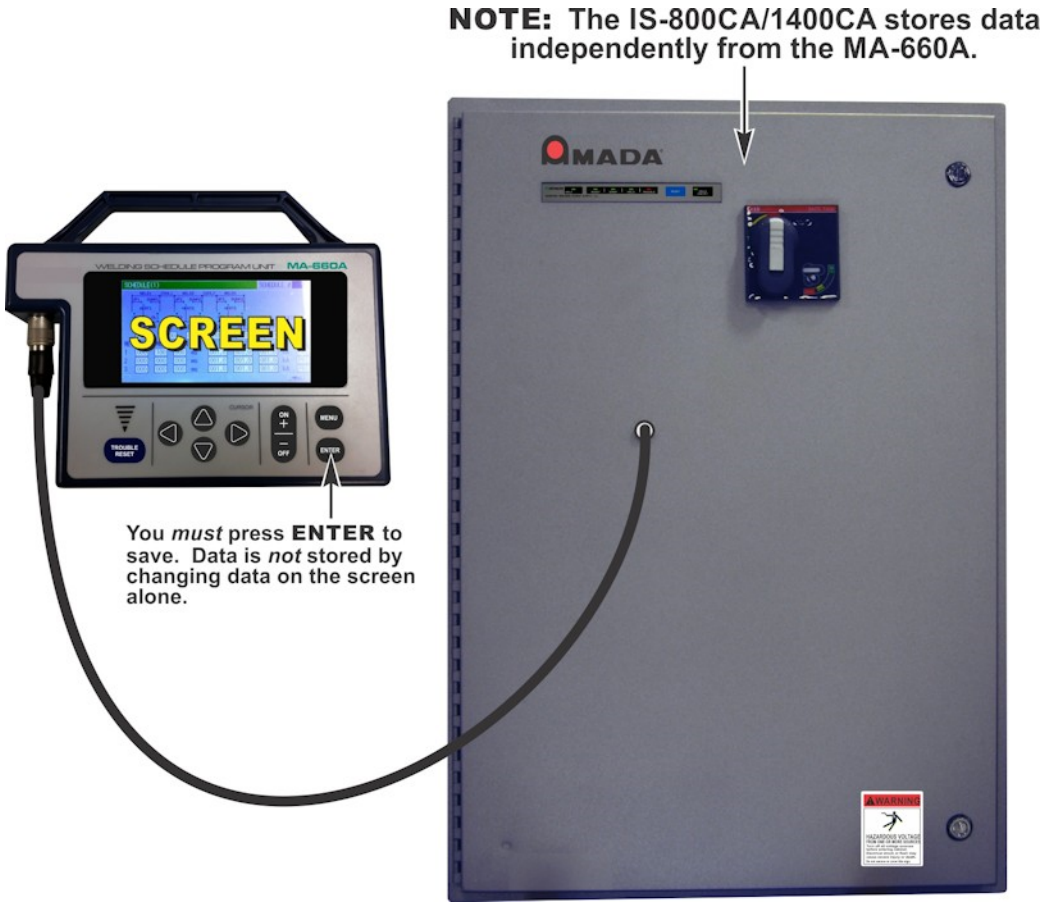
TRANSFORMER SENSING CONNECTOR (Optional Toroidal Coil)

The Toroidal Coil is attached on the transformer away from the Power Supply. The signal comes through the **TRANSFORMER SENSING CONNECTOR** on bottom of Power Supply. The coil is used for the secondary constant-current effective value control and secondary constant-power effective value control.



MA-660A Program Unit ("The Pendant")
(Sold Separately)

The ***Power Supply*** uses the ***Pendant*** to set the weld schedules and see the monitored results. The Pendant is connected to the Power Supply by a cable attached to the connector on the front door of the Power Supply as shown below.



TROUBLE RESET key

Press this key after the cause of trouble is eliminated. Once selected all error messages that appear on the screen will turn off.

CURSOR Keys

Used to move the cursor or to select an item.

+ON/-OFF Keys

Used to change the value of a selected item or turn it on and off.

ENTER Key

Used to write the set or changed value and [ON/OFF] data in the Power Supply connected to the MA-660A. After any data is set or changed, be sure to press this **ENTER** key to write that data before moving the cursor.

If this **ENTER** key is not pressed, the Power Supply connected to the MA-660A will not recognize the set data.

The Power Supply writes data into FLASH ROM on the control board when a setting is changed or a schedule data is copied. The **READY** lamp on the front panel and the external **READY** signal are turned off during writing. Check that the **READY** lamp is turned on to start welding.

It takes about 3 seconds maximum to change a setting, about 125 seconds to copy a schedule, and about 5 seconds maximum to initialize schedules in FLASH ROM. During that time, do not turn off the power.

MENU Key

Used to display the **MENU** screen. Press this key to return to **MENU** screen from any other screen.

CAUTION

No setting changes can be made while the start signal is ON or during a weld sequence.

If a setting is changed during the welding sequence, an error message will appear. Press the **TROUBLE RESET** key to clear the message.

Also, when making a screen change to call up another setting schedule during a welding sequence, the **TROUBLE RESET** key will not work even if the following screen appears. In this case, you need to recycle the power to the Unit.

(When connecting to the Power Supply, **IS-800CA/1400CA Advanced**)

CHAPTER 2
INSTALLATION AND SETUP

Section I: Planning

Environmental Factors

We recommend that you install the Power Supply in a well-ventilated area that is free from excessive dust, weld expulsion, acids, corrosive gasses, salt, moisture, oil, coolant, and contaminants. Allow adequate space around the unit for power and signal cabling runs, water-cooling hose connections, and to open the front door. Electrical input is made from the top of the Power Supply; output power (to the weld transformer) is made from the bottom of the Power Supply. Signal connections may be made from either the top or bottom of the Power Supply.

The Power Supply is designed to work in the following ambient conditions:

- Temperature:41 – 104 °F (5 – 40 °C)
- Humidity: Less than 90%, non-condensing

Space and Mounting Requirements

IS-800CA

IS-1400CA

Power Requirements

Power required for the Power Supply is three-phase, 380 or 480 VAC (nominal), 50-60 Hz. When changing the input voltage, the valve transformer input leads will need to be changed to the new voltage.

NOTES:

- All items other than IS-800CA are sold separately.
- In the secondary constant-current effective value control and secondary constant-power effective value control, a toroidal coil and a volt-sensing cable are required. Connect the volt-sensing cable near an electrode and connect the opposite side of the cable to pins 38 and 39 on the external I/O terminal strip.

  NOTE: If used with AMADA WELD TECH - IT Transformers, you can purchase the 18-045-01 transformer sense cable which will have these connections.
- The screw of terminal block for welding power input (output) is M8 hexagon bolt 18 mm long for the IS-800CA and M12 hexagon bolt 20 mm long with cross-recessed head.

Section II: Installation

CAUTION

- Make sure the mounting location can support the ***weight*** of the unit!
- A "2-man" lift should be used for unpacking and installation due to the weight of the unit!
- We recommend removal of the plates before drilling and punching, but if plates cannot be removed, be sure all metallic shards are removed from the Power Supply after completion of the work.

Unpacking

Unpack the Power Supply from its shipping crate. Carefully save and store packing materials for future storage or shipment of the Power Supply.

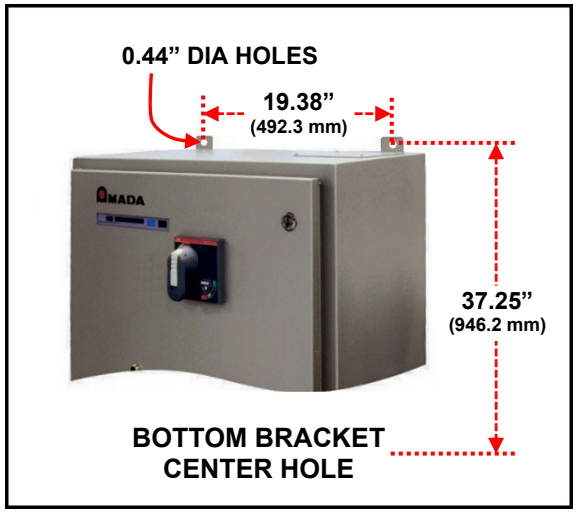
Installation

Installation consists of mounting the unit and making power, signal, and cooling water connections.

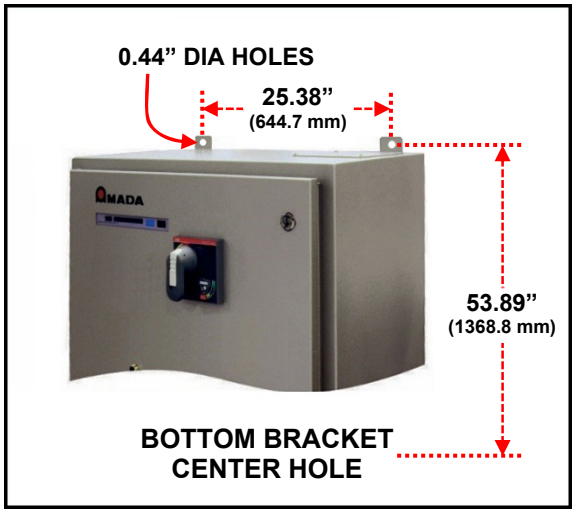
Mounting the Power Supply

The unit has four mounting tabs, two with mounting holes, and two with mounting slots, as shown below. As each installation is different, no mounting hardware is provided with the unit. The holes on the mounting tabs are 0.44-inch diameter, and are designed for 7/16" screws or bolts. You will need to provide the appropriate screws or bolts, flat and lock washers, and nuts.

1. Loosely install the two lower mounting screws.
2. Slide the Power Supply bottom (slotted) tabs into the two lower mounting screws.
3. While the Power Supply is being held in place, install the two upper mounting screws then tighten the two lower mounting screws.



IS-800CA Mounting



IS-1400CA Mounting

Electrical Connections

DANGER

- Do ***not*** install power to the Power Supply without the input power service being turned off and tagged. Serious injury or death can result from contacting live power lines.
- The installer ***must*** make electrical connections in accordance to all applicable codes. For appropriate cable rating, see *Appendix B, Electrical and Data Connections.*

Input Power Connections

Electrical input is made from the top of the Power Supply through the Line-In cover plate. We recommend removal of the cover plate to an area away from the Power Supply before drilling holes. This will reduce the need to protect the electronics from metallic shards that otherwise could damage the unit or injure personnel.

1. Make sure the input 3-phase power coming from the wall is off.
2. Open the front door by turning the two quarter-turn screws and turning the handle.

   NOTE: When the handle is turned and the door opened, the circuit breaker turns OFF.
3. Remove the terminal cover from the top of the circuit breaker by grasping the cover on both sides and pulling it toward you.
4. Remove the four screws that secure the Line-In Cover Plate directly above the circuit breaker.
5. Drill appropriate hole(s) in the plate to receive the input power conduit(s).

   NOTE: *Remove all metal shards,* then re-install the plate.
6. Install service conduit to plate and feed input power cables into the Power Supply.
7. Connect three-phase power cables to the three socket head screws in the circuit breaker. Input is not phase dependent.

8. Connect the ground cable to the chassis ground terminal to the right of the circuit breaker.
9. Slide the circuit breaker terminal cover back on to the circuit breaker.
10. Remove the four screws that secure the Line-Out Cover Plate on the bottom of the Power Supply.
11. Drill appropriate hole(s) in the plate to receive the weld transformer power conduit(s).

    NOTE: ***Remove all metal shards,*** then re-install the plate.
12. Install the weld transformer conduit to the plate and feed cables into the Power Supply.
13. Connect the ground cable to the ground lug.
14. Connect the two transformer cables to connectors labeled U and V in the power module.

Breaker

Breaker Rated Current

Calculate the average Input current using output current (momentary maximum current) and duty cycle:

$$\text{Effective continuous current} = I \times 0.817 \times \sqrt{\frac{\alpha}{100}}$$

(I : Output current (momentary maximum current) of **IS-800CA/1400CA**
α : Duty cycle (%))

Select the breaker rated current of at least the average input current above. Check the coordination of output current (momentary maximum current) and tripping time on the tripping characteristic curve of the breaker to select the appropriate breaker.

Output current = 500 A / Duty cycle = 15%
$500 \times 0.817 \times \sqrt{\frac{15}{100}} = 158$ (A)
Breaker of at least 158 A (e.g., 175 A or 200 A) must be selected.

Input / Output Cable

An input/output cable is determined by the average input current and the average output current. Calculate the average input current and the average output current using output current (momentary maximum current) and duty cycle.

Effective continuous current = I x 0.817 x $\sqrt{\frac{\alpha}{100}}$

Effective continuous current = I x $\sqrt{\frac{\alpha}{100}}$

(I : Output current (momentary maximum current) of **IS-800CA/1400CA**
α : Duty cycle (%))

Check the manufacturer's characteristic table to select the cross section of the cable according to the allowable current. Although a four-core cable is used for input cable and a three-core cable is used for output cable, one of the cores is for grounding. Therefore, use the allowable current of three cores for input cable and that of two cores for output cable.

Output current (momentary maximum current) = 300 A / Duty cycle = 15%

Average input current is as follows.

$300 \times 0.817 \times \sqrt{\frac{15}{100}} = 95$ (A)

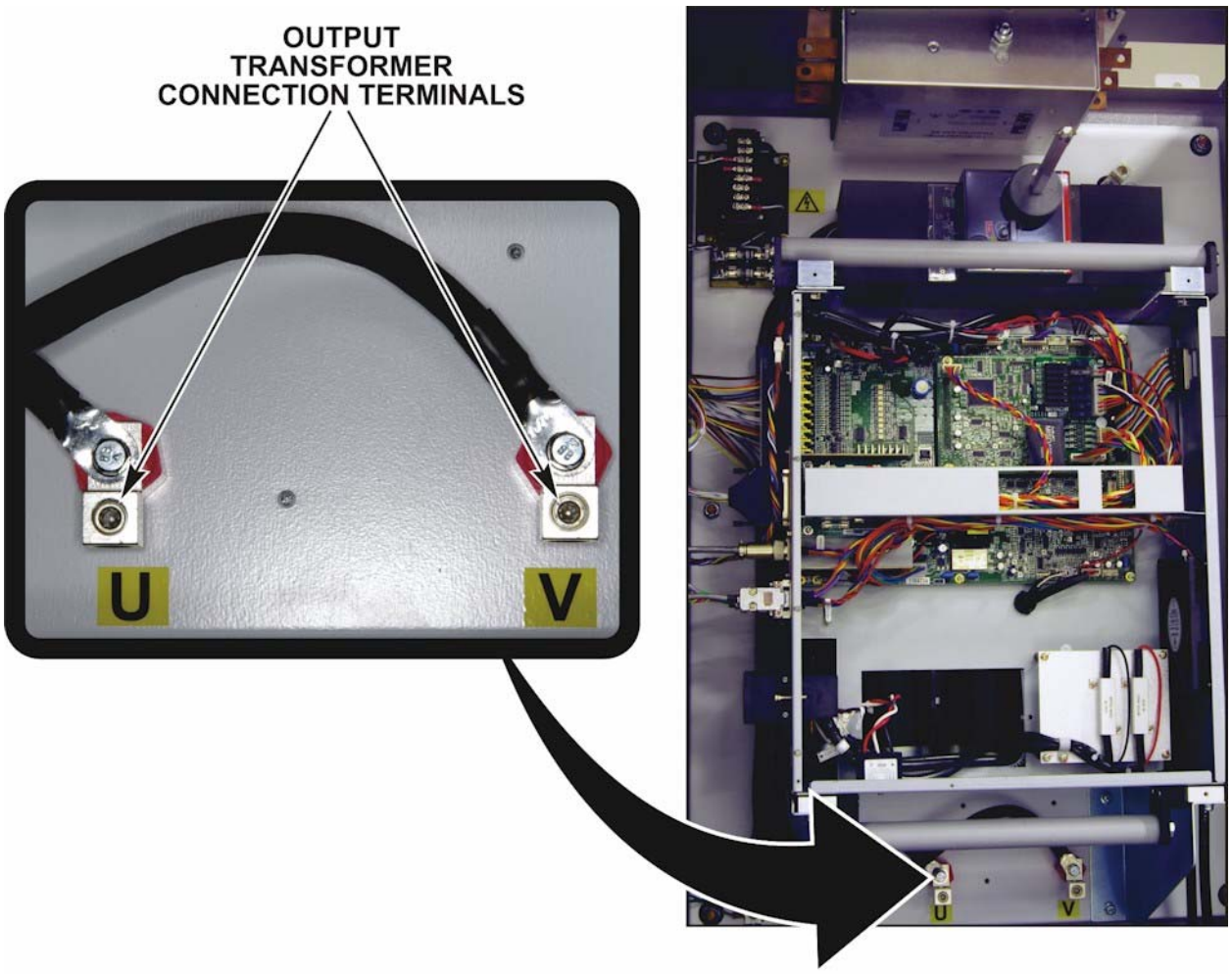
Average output current is as follows.

$300 \times \sqrt{\frac{15}{100}} = 116$ (A)

Use a cable of a nominal cross section with 95 (A) or more of allowable current of three cores for input cable and 116 (A) or more of allowable current of two cores for output cable.

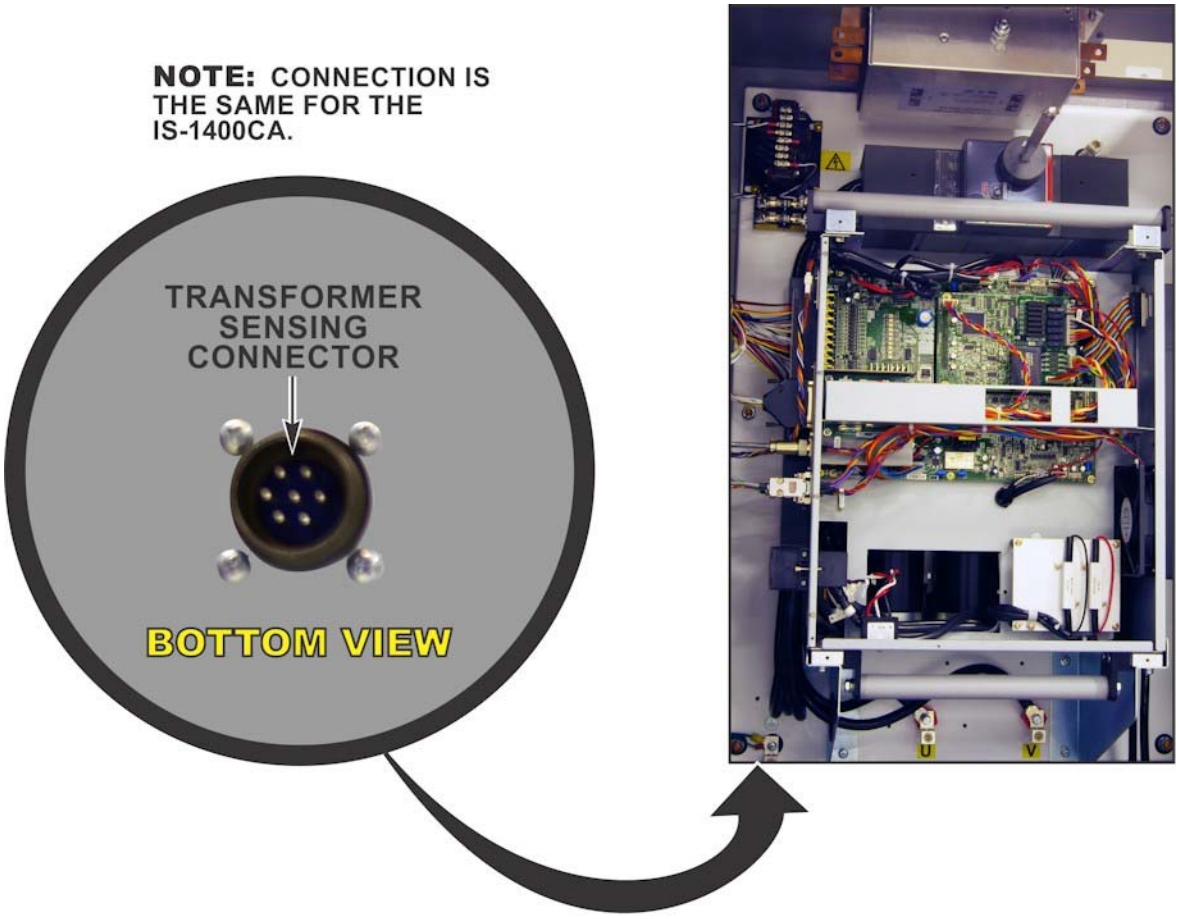
Output Power Connections

Weld transformer connections are made from the bottom of the Power Supply through the Line-Out Cover Plate. We recommend that you remove the cover plate to an area ***away*** from the Power Supply ***before*** drilling holes. This will reduce the need to protect the electronics from metallic shards that otherwise could damage the unit or injure personnel.



Signal Sensing Connections

See *Appendix B, Electrical and Data Connections, Section I, Data Connectors* for connector pin information and *Section II, Input / Output Signal Configuration* for connection and configuration instructions.



Section III: Cooling Water

Cooling Water Requirements

The connections to the Power Supply are made with ⅜" FNPT fittings through the bottom of the Power Supply. We recommend the installation of quick-disconnect fittings to expedite water draining or Power Unit replacement. See *Appendix A, Technical Specifications* for cooling water specifications.

CAUTION: If the temperature drops below 32 °F (0 °C), the water inside the Power Supply can freeze and damage the equipment. If the temperature is likely to drop ***below*** 32 °F (0 °C), drain the water in accordance to the procedure in *Chapter 4, Maintenance*. To prevent condensation, which may damage the Power Supply, do ***not*** run cooling water through an unused Power Supply unit if the water is 4 °F (2.2 °C) ***below*** the minimum operating ambient temperature. Therefore, take special care to keep the water temperature above the minimum operating ambient temperature.

The installation site should be free of sudden temperature fluctuations and the humidity should be ≤ 85% (non-condensing).

CAUTION:

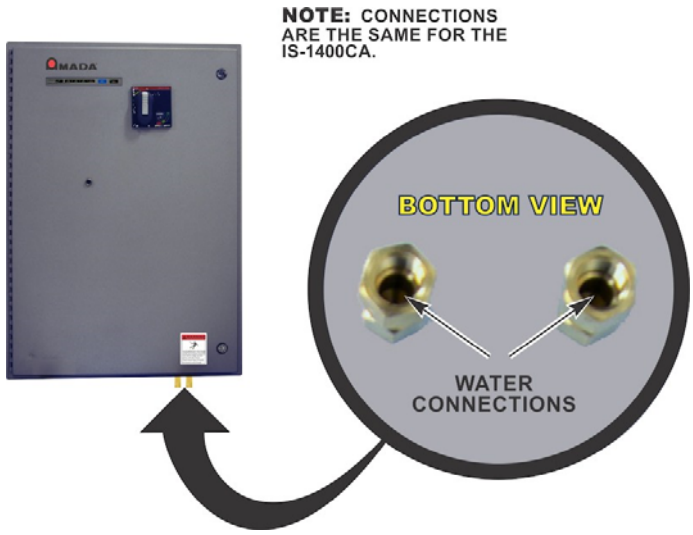
Verify that the cooling water lines do not condense with moisture. If necessary, increase the external cooling water temperature to raise the dew point and prevent condensation.

Cooling Water Hose Connections

CAUTION: Do ***not*** perform service on cooling system unless the Power Supply is turned OFF and breaker handle tagged! (Lock-Out Tag-Out)

NOTE: Internal Cooling Water hoses are factory-installed with quick-disconnect fittings.

1. Install a water flow failure indicator on the water outlet. The flow failure indicator output signals should be connected to the appropriate pins of the I/O Signals terminal block.



2. ***After*** you connect all cooling water hoses, turn the water ON and check for leaks.

   NOTE: Adjust the cooling water flow rate to at least 2 L/min. If it is low, the IGBT thermostat error will be detected and operation will stop.

CHAPTER 3
USING PROGRAMMING FUNCTIONS

Section I. Introduction

This chapter shows Pendant screens used for both **Basic** and **Advanced** models of the Power Supply. Functions related to the **Advanced** models ***only*** will be noted in the text.

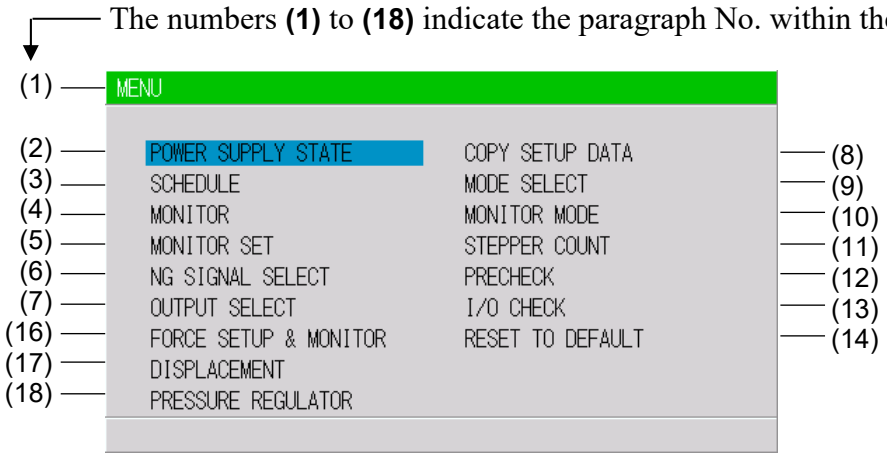
FLASH ROM The Power Supply writes data into FLASH ROM on the control board when a setting is changed or a schedule data is copied. The **READY** lamp on the front panel and the external **READY** signal are turned off during writing. It takes about 2 seconds at longest to change a setting and about 1 minute to copy a schedule into FLASH ROM. During that time, do ***not*** turn the power OFF. When you have finished programming, make sure the **READY** lamp is turned ON in order to start welding.

SHADED CHARACTERS Items for which a value must be input, or which must be set ON or OFF will be shaded. Move the cursor to the item and type in the appropriate changes.

Section II. Programming Options For Basic and Advanced Models

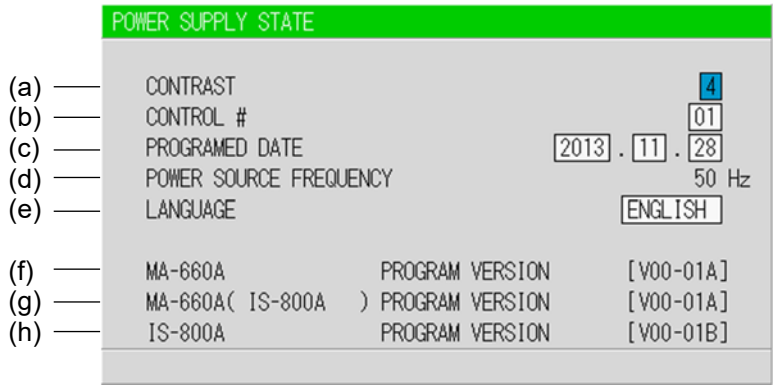
1. MENU Screen

The Pendant has various functions that are set from the respective screens. The **MENU** screen displays these functions in menu form.
Move the cursor ( ) to the desired item; press the **ENTER** key to move to the selected screen.



2. POWER SUPPLY STATE Screen

This screen is used to display and set data for the Power Supply. Move the cursor to change the value.



a. LCD CONTRAST

Sets the screen contrast. The contrast can be set in a range from 0 to 9. The larger the value, the darker the screen. Adjust the contrast if the screen is difficult to view.

b. CONTROL #

Input the identification No. of your Power Supply.
If you have two or more Power Supply units, input 01 for the first one, 02 for the second one, 03 for the third one, and so on. Used for communication.

c. PROGRAMMED DATE

Input the date on which a schedule is set as data. The date does not affect the set schedule. When the Power Supply memory is initialized, the date is also initialized to the date on which the ROM version is created.

d. POWER SOURCE FREQUENCY

The frequency of the welding power is measured and indicated automatically.

e. LANGUAGE

Select the language from Japanese and English.

f. MA-660A the Pendant ROM VERSION #

Indicates the ROM version No. of the Pendant.

g. MA-660A the Pendant (IS-800CA / 1400CA) PROGRAM VERSION

Indicates the program version No. of the Power Supplies screen display part.

h. IS-800CA (IS-1400CA) ROM VERSION #

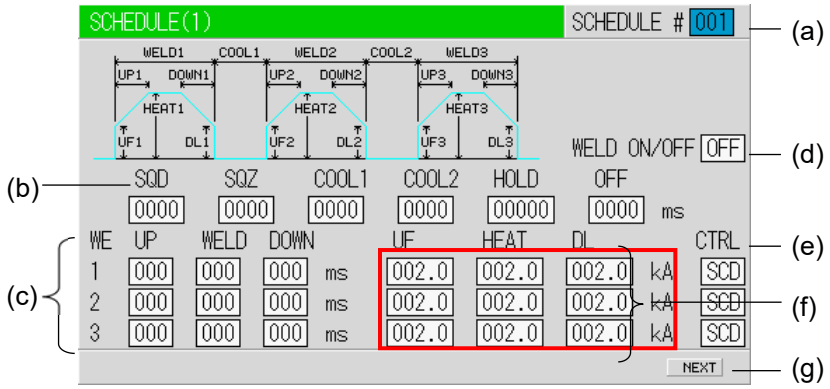
Indicates the ROM version No. of the Power Supply.

3. SCHEDULE Screen

Up to 255 welding schedules can be set on the Power Supply. These schedules are indicated as SCHEDULE #1 to #255. In the SCHEDULE screen, there is a Current and time setting screen and a PULSATION and transformer screen.

CURRENT and TIME Setting Screen

This screen is used to set the SCHEDULE No., length of weld time, welding current, and so on. The ms mode or CYC mode can be changed via WELD TIME (Refer to (9)(h)) on the MODE SELECT screen.



NOTE: The screen shows the settings for **IS-800CA**. The settings surrounded with frames are 004.0 kA for **IS-1400CA**. Also, unit, resolution, and setting range change depending on the settings of CTRL/CURR RANGE.

a. SCHEDULE

Select from #1 to #255 to set the SCHEDULE. Normally select #1 first, then select additional schedules in sequential order.

b. TIME

Set the time for each operation during welding.
Units of time are in ms or CYC. The screen above is in ms setting. CYC can be selected via the MODE SELECT screen. See the Timing Chart for each operation.

SQD / Squeeze delay time	Length of time added to SQZ; only for the first weld after start signal in repeat operation
SQZ / Squeeze time	Length of time until proper squeeze is applied to workpiece
COOL1 and **COOL2** Cooling time 1 and Cooling time 2	Length of time to cool workpiece after turning off welding current
HOLD / Hold time	Length of time to hold workpiece after turning off welding current
OFF / Off time (*)	Length of time to turn off valve signal between repeated operations (No repeat operation if set to "0" or the upper/lower limit judgment error occurs in a sequence.)

* OFF/Off time

- Count and step value are updated each welding.
- **RE-WELD** does not work simultaneously with **OFF**. When **OFF** is set, **RE-WELD** becomes invalid.
- **START SIG.MODE** has limitations. When OFF is set, **MAINTAINED** of **START SIG.MODE** does not work. It works as **LATCHED**.

c. WELD (1, 2, 3)

Set the length of time to allow welding current to flow. As units of time, ms and CYC may be selected. Either unit can be selected via the MODE SELECT screen.

UP (1, 2, 3)

Set the upslope time (to increase the welding current gradually).

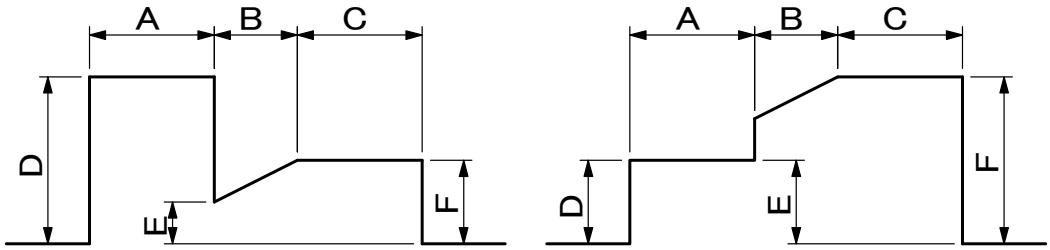
DOWN (1, 2, 3)

Set the downslope time (to decrease the welding current gradually).

NOTE: Upslope / Downslope waveform when COOL (cooling time) is set to 0. The welding current normally increases from the UF set value to the HEAT set value and decreases from the HEAT set value to the UF set value, but E-10 (Schedule setting error) will occur when the Power Supply starts with the following setting.

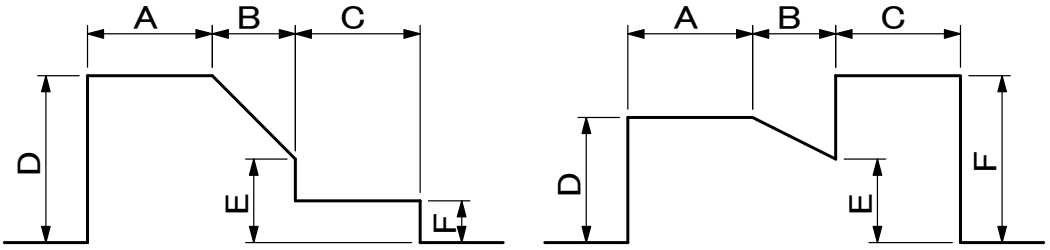
When the control methods for the previous and subsequent stages in the multi-stage welding are changed. The control method for the previous stage is different from that for the subsequent stage.

When the upslope time is set for the subsequent stage in the multi-stage welding, the upslope time is set for the subsequent stage, and the **HEAT** setting of **D** and the **UF HEAT** setting of **E** are different.



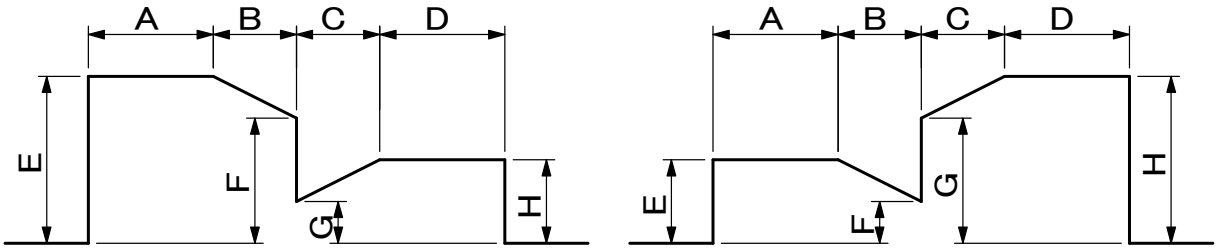
A: WELD1 time or WELD2 time
B: UP2 time or UP3 time
C: WELD2 time or WELD3 time
D: WELD1 HEAT or WELD2 HEAT
E: UF2 HEAT or UF3 HEAT
F: WELD2 HEAT or WELD3 HEAT

When the downslope time is set for the previous stage in the multi-stage welding, the downslope time is set for the previous stage, and the **DL HEAT** setting of **E** and the **HEAT** setting of **F** are different.



A: WELD1 time or WELD2 time
B: DOWN1 time or DOWN2 time
C: WELD2 time or WELD3 time
D: WELD1 HEAT or WELD2 HEAT
E: DL1 HEAT or DL2 HEAT
F: WELD2 HEAT or WELD3 HEAT

When the slope times are set for the previous and subsequent stages in the multi-stage welding. The downslope time is set for the previous stage, the upslope time is set for the subsequent stage, and the **DL HEAT** setting of **F** and the **UF HEAT** setting of **G** are different.



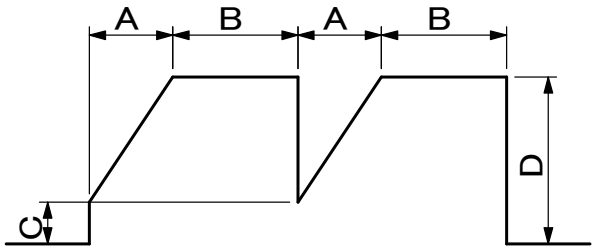
A: WELD1 time or WELD2 time
B: DOWN1 time or DOWN2 time
C: UP2 time or UP3 time
D: WELD2 time or WELD3 time
E: WELD1 HEAT or WELD2 HEAT
F: DL1 HEAT or DL2 HEAT
G: UF2 HEAT or UF3 HEAT
H: WELD2 HEAT or WELD3 HEAT

NOTES:

- Set 1 (ms/CYC) or more for at least one of WELD1, WELD2 and WELD3. Also, set the total time of UP and DOWN to be shorter than WELD. If not, E-10 (Schedule setting error) will be displayed.

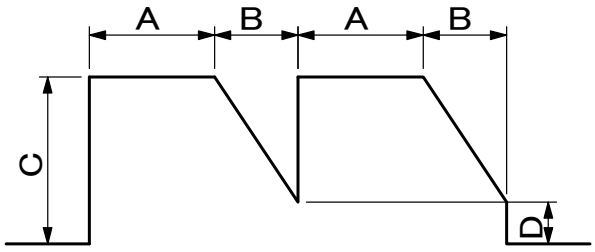
- Upslope / Downslope waveform when INT (downtime) is set to 0.
- E-10 (Schedule setting error) will occur when the Power Supply starts with the setting below.

When the upslope time is set in the pulsation welding. The upslope time is set, and the UF HEAT setting of C and the HEAT setting of D are different.



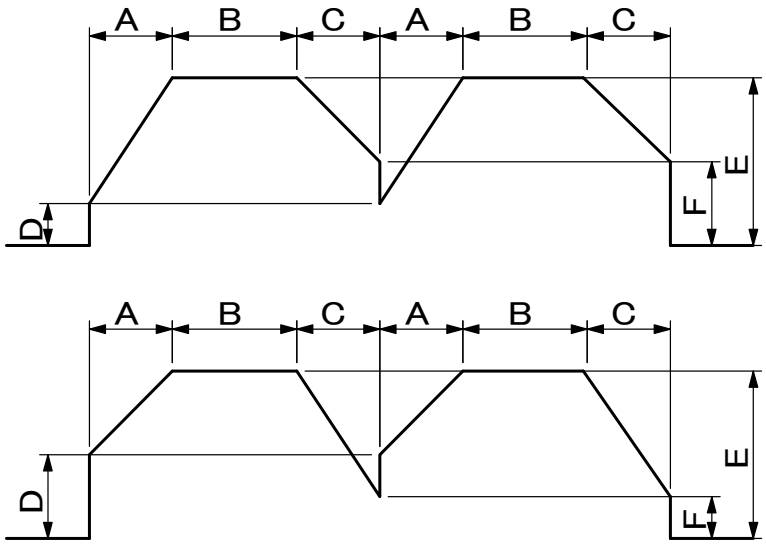
A: UP1 to 3 time
B: WELD1 to 3 time
C: UF1 to 3 HEAT
D: HEAT1 to 3

When the downslope time is set in the pulsation welding. The downslope time is set, and the **HEAT** setting of **C** and the **DL HEAT** setting of **D** are different.



A: WELD1 to 3 time
B: DOWN1 to 3 time
C: HEAT1 to 3
D: DL1 to 3 HEAT

When the upslope time and the downslope times are set in the pulsation welding. The upslope time and the downslope time are set, and the **UF HEAT** setting of **D** and the **DL HEAT** setting of **F** are different.



A: UP1 to 3 time
B: WELD1 to 3 time
C: DOWN1 to 3 time
D: UF1 to 3 HEAT
E: HEAT1 to 3
F: DL1 to 3 HEAT

d. WELD ON/OFF

One of the settings required to turn the READY lamp of the Power Supply ON.

NOTE: Even if this switch is ON, the Power Supply cannot supply welding current if the WELD ON/OFF key on the front panel or external WELD ON/OFF signal is OFF. In order for the Power Supply to supply welding current, this switch, the WELD ON/OFF key, and the external WELD ON/OFF signal must all be ON.

e. CTRL

Select one from the following six welding current control methods for **WE1**, **WE2** and **WE3**, respectively. Press **+ON/-OFF** key to switch the setting. The initial setting is the secondary constant-current effective value control (**SCD**).

Display	Control method
PRI	Primary constant-current effective value control
SCD	Secondary constant-current effective value control
PWR	Secondary constant-power effective value control
PLM	Primary constant-current peak value control
VLT	Secondary constant-voltage effective value control
FPL	Constant-phase control

(Note) Control method of the inverter-type welding power supply

CONTROL METHOD	FEATURE	APPLICATION	CONTROL MECHANISM
Primary constant-current control (PWM effective value control)	Requires no connection of toroidal coil on the secondary side of the transformer. Requires turn ratio setting of the inverter-type transformer. The loss inside the transformer is not considered.	Used for welding in a robot or an environment where the weld head moves and that causes disconnection of toroidal coil and cable.	Detects the primary current by the current sensor mounted into the power supply to compare the measured current obtained by calculating with each control frequency to the primary current obtained by "set current ÷ turn ratio", and controls pulse width so that there is no difference in these values.
Secondary constant-current control (PWM effective value control)	Compared to the primary constant-current control, the current accuracy is high since the welding is directly controlled, being detecting the welding current.	Commonly used for general welding.	Detects the welding current with toroidal coil to compare the measured current obtained by calculating with each control frequency to the set current, and controls pulse width so that there is no difference in these values.
Secondary constant-power control (PWM effective value control)	Controls so that the power between electrodes becomes constant. Responds to change in work piece state during welding to make heat input constant.	Used when you want to reduce expulsion in early welding, shunt current is occurred at welding, or make heat generation constant.	Detects the welding current with toroidal coil and the voltage between electrodes with the voltage detecting cable to compare the power calculated by the measured current obtained by calculating with each control frequency and voltage to the set current, and controls pulse width so that there is no difference in these values.
Primary constant-current peak value control (PWM peak value control)	Requires no connection of toroidal coil on the secondary side of the transformer. Requires turn ratio setting of the inverter-type transformer. The loss inside the transformer is not considered. Compared to the effective value control, the rise of the current is fast, but the effective current changes depending on how large the current ripple is.	Used for welding of coated metal or dissimilar metal.	Sets the primary current obtained by the set current and the transformer turn ratio as current limiter, and controls pulse width so that the switching is turned off when the primary current detected by the current sensor mounted into the power supply has reached to the current limiter.
Secondary constant-voltage control (PWM effective value control)	Controls with the voltage between electrodes. Provides welding without expulsion by making voltage from the rise constant and reducing the current.	Used for welding of high specific resistance material, welding of high contact resistance work piece such as cross wire, and projection welding, which has resistance change in early welding to reduce expulsion.	Detects the voltage between electrodes with the voltage detecting cable to compare the measured current obtained by calculating with each control frequency to the set voltage, and controls pulse width so that there is no difference in these values.
Constant-phase control (Non-constant current)	Welding with the fixed pulse width. No feedback control.	Used for special cases such as the test of welder, and not used for normal welding.	Controls switching with the set pulse width.

f. HEAT

Set the welding current for **WELD1**, **WELD2**, and **WELD3**, respectively. When **CTRL** is changed, the content to be set also change. Also, the settable range of welding current changes depending on the current range.

UF (UP SLOPE FIRST)

Sets the initial current value of upslope. The set value is the as **HEAT**.

DL (DOWN SLOPE LAST)

Sets the final current value of downslope. The set value is the as **HEAT**.

NOTE: When **UP/DOWN** is set, **UF/DL** becomes effective. It becomes a target value in the effective value control, so a difference occurs between the set value and the value of actual welding.

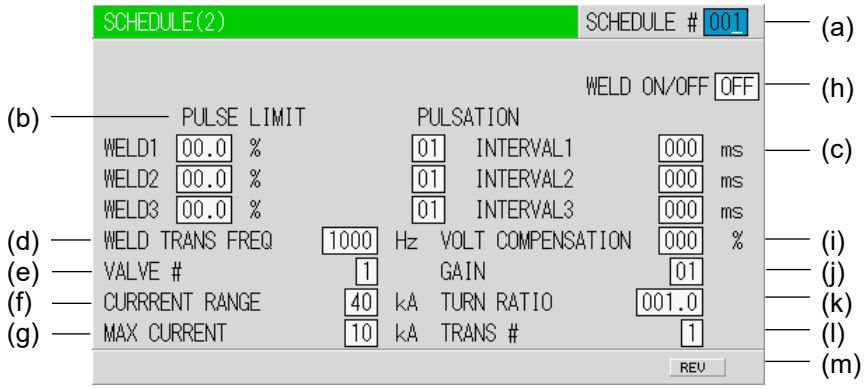
DANGER

Even though E-07 (No-current error) is displayed, current is flowing. Exercise caution in handling.

g. NEXT

When the cursor is at▼, moving the cursor down will change the display to **PULSATION** and transformer screen.

PULSATION and transformer screen



a. SCHEDULE

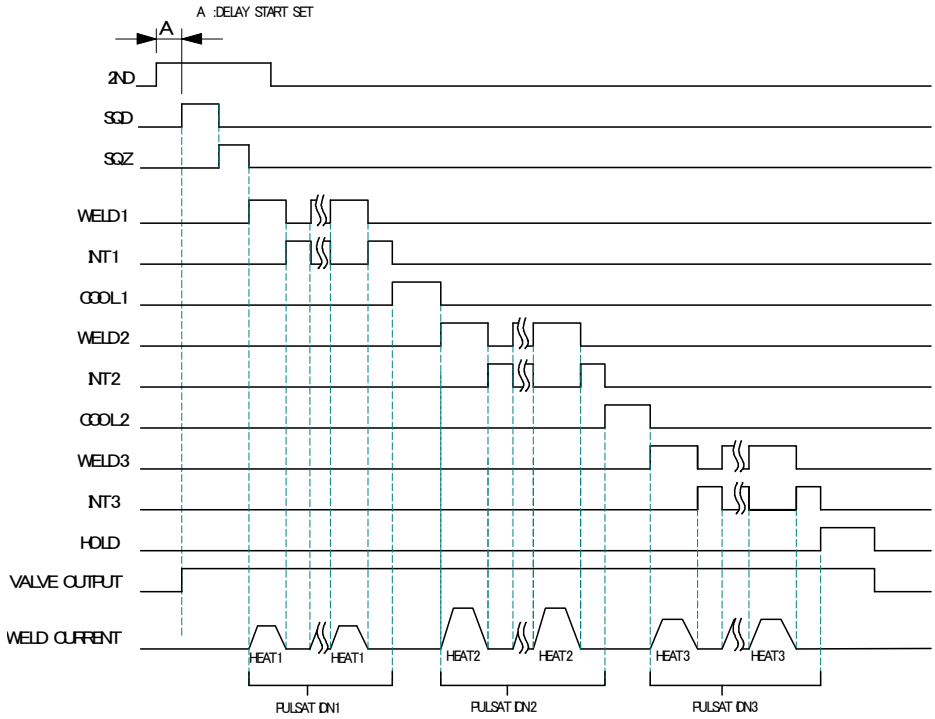
Select from #1 to #255 to set the **SCHEDULE**. Normally select #1 first, then select additional schedules in sequential order.

b. PULSE LIMIT

When limiting the pulse width in Primary constant-current peak value control, set the limit for each of **WE1**, **WE2** and **WE3**.

c. PULSATION / INTERVAL 1 to 3

Set the number of repetitions **PULSATION (01 to 19)** and the downtime (**INT1** to **3**) in **WE1** to **3** (See the figure below). However, when the number of repetitions is set to 01, the downtime does not work.



- When performing a welding with the setting **PULSATION** to **02** or more and **INT1** to **3** to **0**, set the control system to the primary constant-current effective value control or the primary constant-current peak value control. If a welding is performed with the other controls, control and monitored value may not function correctly.
- When performing a welding with the setting **PULSATION** to **02** or more, only the last welding data is displayed as the monitored value of **WELD2** after completion of sequence. In the timing chart above, the data of the third time is displayed, see the **MONITOR** screen. If the current gets out of the range of upper/lower limit judgment during repeated **PULSATION** operation, a caution signal is output after completion of welding (see the **MONITOR SET** screen.)

d. WELD TRANS FREQ

Sets the frequency of the welding transformer to be used. **Basic** models can be set from 600 Hz to 3,000 Hz in units of 100 Hz. **Advanced** models can be set from 600 Hz to 1,000 Hz. If a value greater than 1,000 Hz is entered, a SET ERROR message will display upon firing.

CAUTION

Do ***not*** use the welding transformer whose frequency is higher than the output frequency of the inverter power supply, this will cause a malfunction. When setting the output frequency of the inverter power supply, check the frequency of the welding transformer.

e. VALVE

Use this setting to select which of the valves to use. **Basic** models have two valves available, while **Advanced** models have four.

f. CURRENT RANGE

Selects the current range in accordance with the welding current to use.

	IS-800CA		IS-1400CA	
Range	**Current Setting Range**	**Power Setting Range**	**Current Setting Range**	**Power Setting Range**
80 kA	---	---	004.0 to 080.0 kA	004.0 to 120.0 kW
40 kA	002.0 to 040.0 kA	002.0 to 060.0 kW	002.0 to 040.0 kA	002.0 to 060.0 kW
20 kA	001.0 to 020.0 kA	001.0 to 020.0 kW	001.0 to 020.0 kA	001.0 to 020.0 kW
10 kA	00.50 to 09.99 kA	00.50 to 09.99 kW	00.50 to 09.99 kA	00.50 to 09.99 kW
05 kA	00.05 to 05.00 kA	00.05 to 05.00 kW	00.05 to 05.00 kA	00.05o 05.00 kW

g. MAX CURRENT

Sets the maximum current of transformer.

h. WELD ON/OFF

One of the settings required to turn on the **READY** lamp of the Power Supply.
ON: **WELD ON** **OFF**: **WELD OFF**

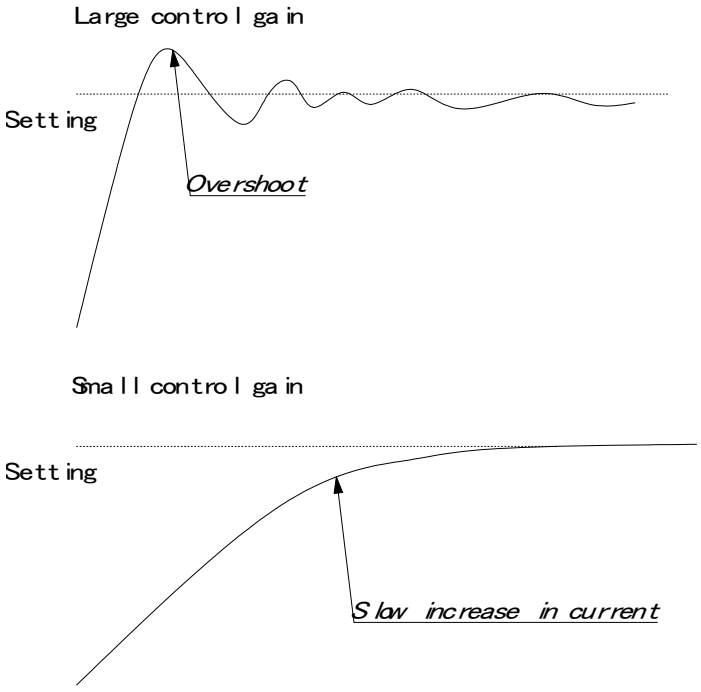
i. VOLT COMPENSATION (effective when PULSE LIM is set)

Compensates the pulse limit for the fluctuation in the three-phase power-supply voltage on the primary side. However, the compensation is for power-supply voltage prior to welding, and not applied during welding. The setting range is 000 to 100%.

j. GAIN (01-09)

Sets the amount of feedback correction in the primary constant-current effective value control, secondary constant-current effective value control, secondary constant-power effective value control, and secondary constant-voltage effective value control. Though 1 is normally used, the larger value will give the shorter rise time. (Invalid in the primary constant-current peak value control and the constant-phase control.)

NOTE: Control gain refers to a correction amount in feedback control. Although the current rises more rapidly with greater control gain, the current waveform may experience overshoot. On the other hand, a smaller control gain suppresses current waveform overshoot but causes a slower increase in current. The Power Supply offers nine 9 choices of gain levels.



k. TURN RATIO

Set the welding transformer turns ratio. The turns ratio can be set in a range from 001.0 to 199.9.

NOTE: When using the primary constant-current effective value control or primary constant-current peak value control, always set the correct turns ratio. An incorrect ratio will result in incorrect output.

l. TRANS

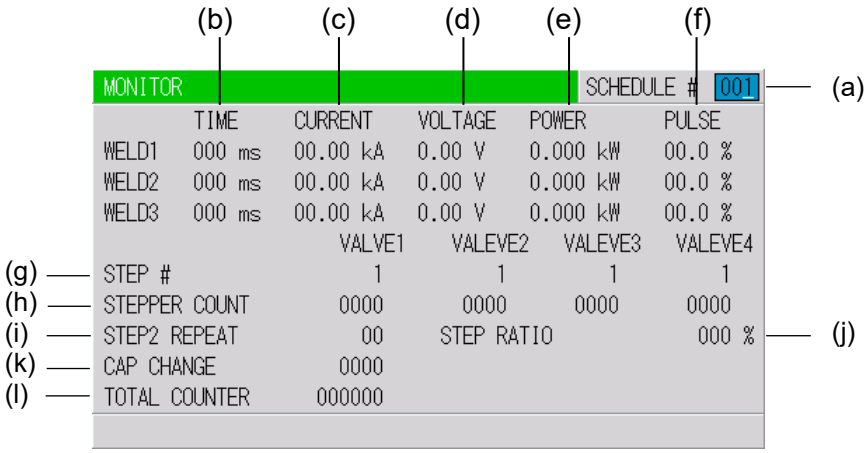
Keep set to **1**. Feature is not active and not shown on **Basic** models.

m. REV

When the cursor ( ) is displayed, pressing the **ENTER** key will change the display to Current and time setting screen.

4. MONITOR Screen

In this screen, you can confirm the operational conditions during welding. Monitored data is displayed for each **SCHEDULE**.



NOTE: The screen shows the settings for 10 kA or 05 kA range. In 20 kA, 40 kA, or 80 kA range, CURRENT is 000.0 kA to 999.9 kA and POWER is 000.0 kW to 999.9 kW.

a. SCHEDULE

Set the No. of the **SCHEDULE** to monitor. The measured values (welding current, voltage, etc.) for welding within that **SCHEDULE** are displayed. The Power Supply stores the latest measured values of each **SCHEDULE** number. The stored measurement values are not erased even when the power is turned off, and thus can be checked for the next job.

b. TIME

The lengths of periods during which current was supplied in the course of **WELD1**, **WELD2** and **WELD3** operations are displayed. The latest measured value welded with the displayed **SCHEDULE** No. is displayed. As units of time, ms and CYC may be selected. Either unit can be selected via the **MODE SELECT** screen.

c. CURRENT

The current during which current was supplied in the course of **WELD1**, **WELD2** and **WELD3** operations are displayed. The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

d. VOLTAGE

The voltage during which current was supplied in the course of **WELD1**, **WELD2** and **WELD3** operations are displayed. To display the voltage, you need to measure the secondary voltage by connecting the voltage detecting cable. The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

e. POWER

The power during which current was supplied in the course of **WELD1**, **WELD2** and **WELD3** operations are displayed. The value calculated from current and voltage (current x voltage) is displayed. To display the voltage, you need to measure the secondary voltage by connecting the voltage detecting cable. The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

f. PULSE

The widest pulse among the supplied primary pulse current is displayed as a percentage of pulse width in full wave mode. The pulse width in full wave mode varies with the frequency setting (**WELD TRANS FREQ**). The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

NOTE: The value displayed on the MONITOR screen is the average of value sampled at each welding pulse. Therefore, the value may differ from the measurement value of a weld checker (**MM-370B** etc.).

g. STEP

The present number of steps is displayed when **STEPPER MODE** is not OFF on the MODE SELECT screen.

h. STEPPER COUNT

The number of welds in the present step is displayed when **STEPPERMODE** is not OFF on the MODE SELECT screen

i. STEP2 REPEAT (Advanced Models ONLY)

Remaining number of repetition for the stepper used for STEP2 of the displayed SCHEDULE is displayed when **STEPPERMODE** is not OFF on the MODE SELECT screen. The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

j. STEP RATIO (Advanced Models ONLY)

The step-up (-down) ratio is displayed when **STEPPERMODE** is not OFF on the MODE SELECT screen. The latest measured value welded with the displayed **SCHEDULE** No. is displayed.

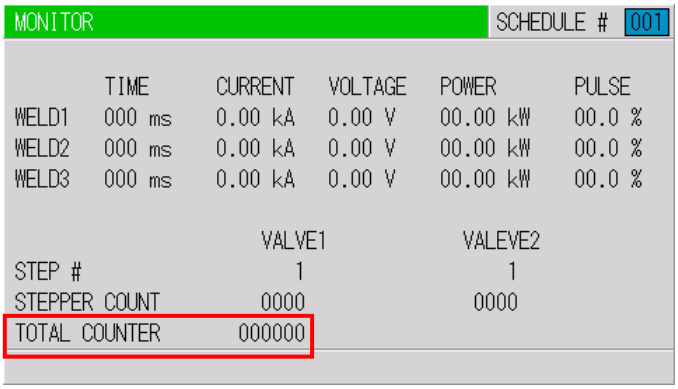
k. CAP CHANGE

The number of times before prior notice for cap change setting for the stepper used for the displayed SCHEDULE is displayed when STEPPERMODE is not OFF on the MODE SELECT screen. The latest measured value welded with the displayed SCHEDULE No. is displayed.

l. TOTAL COUNTER

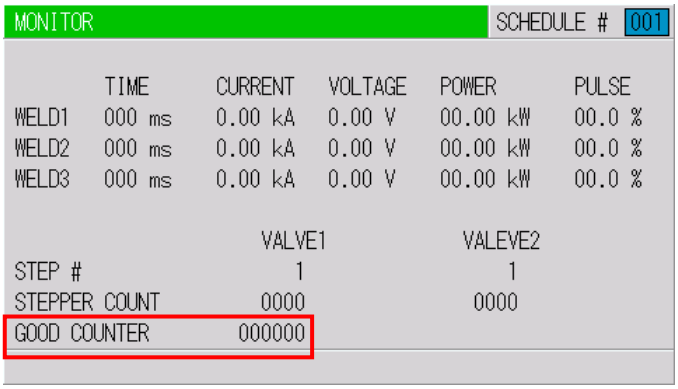
The display changes depending on the setting of WELD2 STOP/WELD COUNT and COUNTER on the MODE SELECT screen.

1. When **WELD2 STOP/WELD COUNT** is **WELD2 STOP** and **COUNTER** is **TOTAL**



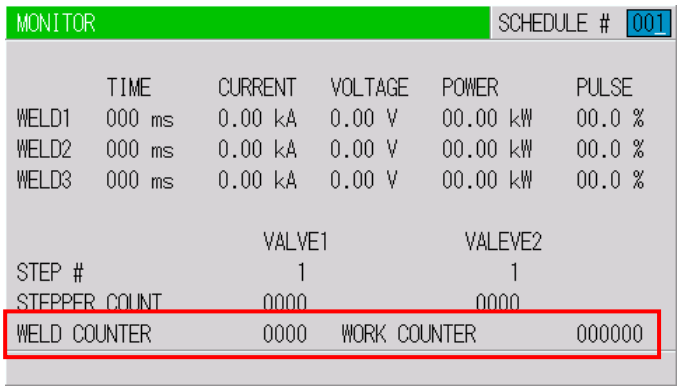
TOTAL COUNTER is displayed. The count value is incremented by one despite the result of the upper/lower limit judgment in monitoring.

2. When **WELD2 STOP/WELD COUNT** is **WELD2 STOP** and **COUNTER** is **GOOD.**



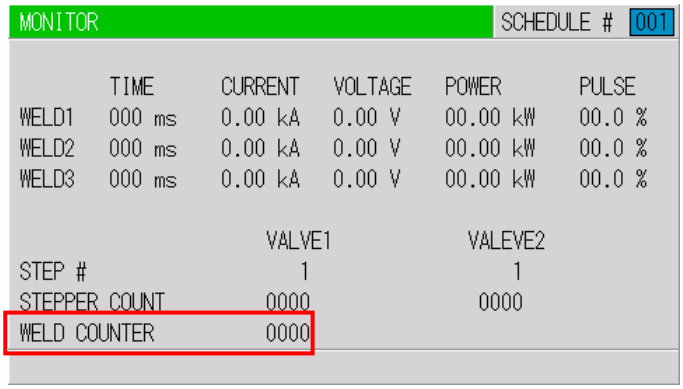
GOOD COUNTER is displayed. The count value is incremented by one when the monitored value is within the range of the upper/lower limit.

3. When **WELD2 STOP/WELD COUNT** is **WELD2 STOP and COUNTER is WORK:**



WELD COUNTER and **WORK COUNTER** are displayed. When the count reaches the set **WELD** count value, **WORK** count value is incremented by one. This is different from **WELD COUNTER** described below.

4. When **WELD2 STOP/WELD COUNT** is **WELD COUNT:**



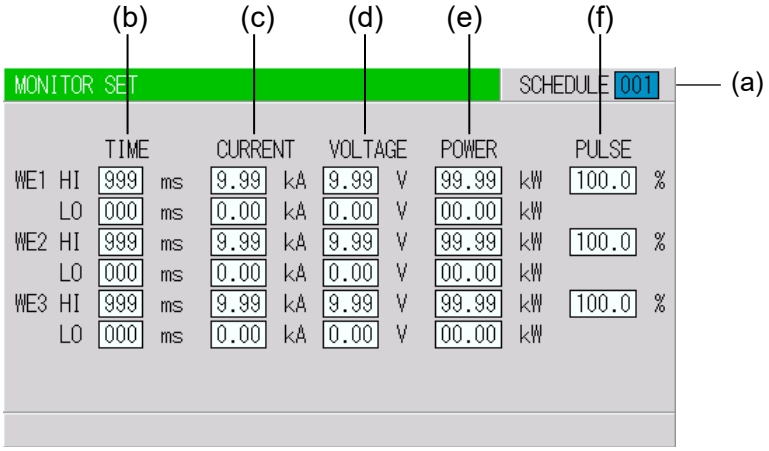
WELD COUNTER is displayed.
This is different from **WELD COUNTER** described above.

Monitored Value Notes:

- Only the last monitored value and the number of counts of each **SCHEDULE** are kept for a period of 10 days after the power is turned off.
- When the repetition welding is performed with **PULSATION** or OFF time setting, only the last data is displayed as the monitored value. The passing data is not displayed.
- The monitor display is not automatically updated depending on the **MONITOR DISP MODE** setting.

5. MONITOR SET Screen

Set the conditions for determining a good or bad weld, including values for welding current, upper or lower limits for the secondary voltage, etc. If the monitored welding current, secondary voltage, etc., do not meet the set conditions, a caution signal is output, and can be used to activate an alarm buzzer, alarm lamp, or similar event.



(Note) The screen shows the settings for 10 kA or 5 kA range. In 20 kA, 40 kA, or 80 kA range, CURRENT is 000.0 to 999.9 kA and POWER is 000.0 to 999.9 kW.

a. SCHEDULE

Input the number of the **SCHEDULE** to monitor.

b. TIME

Set the upper limit (**HI**) and lower limit (**LO**) of the weld time for each of **WE1**, **WE2** and **WE3**. Use this function to monitor the weld time when it becomes unstable by the welding stop input.

c. CURRENT

Set the upper limit (**HI**) and lower limit (**LO**) of the welding current for each of **WE1**, **WE2** and **WE3**.

d. VOLTAGE

Set the upper limit (**HI**) and lower limit (**LO**) of the secondary voltage for each of **WE1**, **WE2** and **WE3**.

e. POWER

Set the upper limit (**HI**) and lower limit (**LO**) of the electric power for each of **WE1**, **WE2** and **WE3**.

f. PULSE

If the ratio of welding current pulse / pulse width in full wave mode exceeds the percentage set in the **PULSE HIGH**, an **ERROR** signal is output. Pulse width is expressed assuming that the full wave is 100%.

NOTE: Upper/Lower limit judgment value when **STEPPER MODE** is set to **ON**

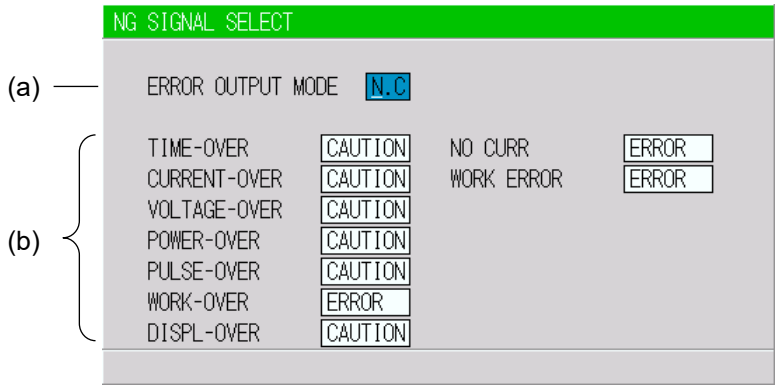
The upper/lower limit judgment value set here is for the current when a welding is performed, not for the initial setting. Therefore, when **STEPPER MODE** is set to **ON** to perform step-up (step-down) for the initial setting, the upper/lower limit judgment value is stepped up or down automatically.

EXAMPLE: When the current is set to 2 kA, HI; 2.2 kA, LO; 1.8 kA. When the step becomes 150%, **H** and **L** become as follows.

H: 2.2 x 1.5 = 3.3 kA
L: 1.8 x 1.5 = 2.7 kA

6. NG SIGNAL SELECT Screen

Sets the output mode and the signal for each item to output, **ERROR** or **CAUTION**, in an error occurring.



NOTE: This screen shows initial settings.

a. ERROR OUTPUT MODE

Sets the output modes of **NG1** of the external output signals.

N.C.	(NORMAL CLOSE) Closed at normal / Open at error
N.O.	(NORMAL OPEN) Open at normal / Closed at error

NOTE: NG2 is N.O. only

b. TIME-OVER / CURR-OVER / VOLT-OVER / POWER-OVER / PULSE-OVER / NO CURR / WRK ERR.

Sets the signal to output, **ERROR** or **CAUTION**. The signal is output in the following states.

TIME-OVER	When the weld time exceeds the upper/lower limit
CURRENT-OVER	When the current exceeds the upper/lower limit
VOLTAGE-OVER	When the voltage exceeds the upper/lower limit
POWER-OVER	When the power exceeds the upper/lower limit
PULSE-OVER	When the pulse width exceeds the upper limit
WORK-OVER	**Advanced models ONLY.** When the work piece detection by displacement measurement exceeds the upper/lower limit
DISPL-OVER	**Advanced models ONLY.** When the final displacement by displacement measurement exceeds the upper/lower limit
NO CURR	When the no-current error occurs (For the no-current error, see **Troubleshooting**.)
WORK ERROR	When the pre-check error occurs

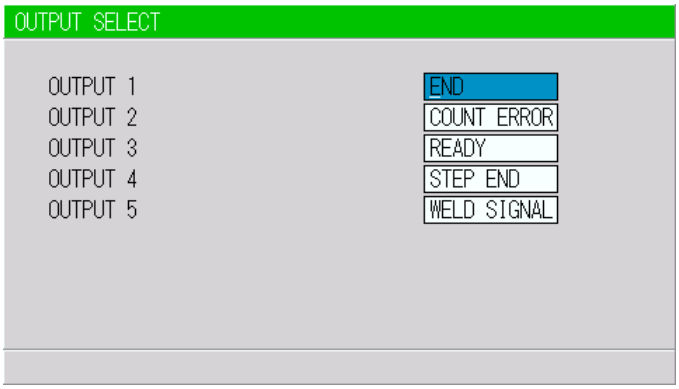
When two or more items are the same settings, the **ERROR** signal or the **CAUTION** signal is output if either one meets the condition above.

NOTE: Receiving the start signal after error output and Continuous welding operation

		START SIGNAL AFTER ERROR OUTPUT	CONTINUOUS WELDING WITH OFF TIME (OFF)
Upper/lower limit monitor error	**ERROR**	Receive	Stop
	CAUTION	Receive	Not stop
No-current error, Work piece error	**ERROR**	Not receive	Stop
	CAUTION	Receive	Stop
Counter error		Receive	Stop
Other device error		Not receive	Stop

7. OUTPUT SELECT Screen

Sets the output signals OUT1 (Pin 28) to OUT5 (Pin 32) of the external output signals.



NOTE: This screen shows initial settings.

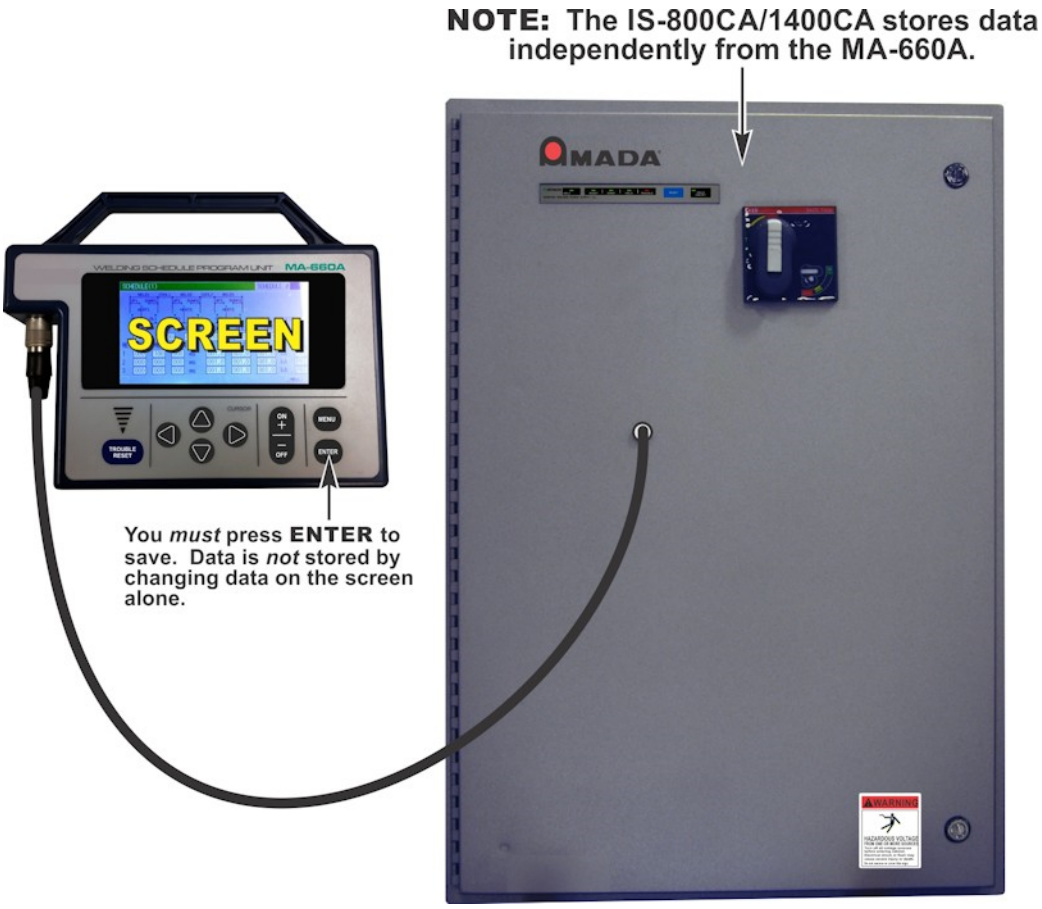
Pressing the **+ON** key switches the signal in the following order (in the reverse direction when pressing -**OFF** key):

END (end signal) → **COUNT ERROR** (count error signal) → **READY** (ready signal)
→ **STEP END** (step end signal) → **WELD SIGNAL** (welding timing signal)
→ **GOOD** (normal signal) → **COUNT UP** (count up signal)
→ **OUT I** (OUT I timing output) → **OUT II** (OUT II timing output)

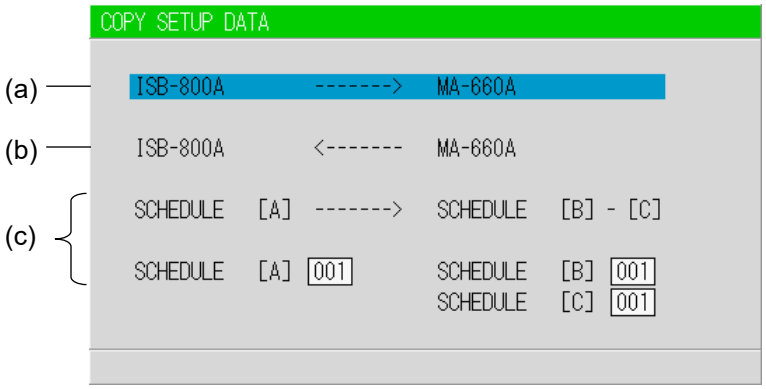
For output timings of **END**, **WELD SIGNAL**, **GOOD**, **OUT I**, and **OUT II**, see the Timing Chart.

8. COPY SETUP DATA Screen

The Pendant can store data as shown in the figure below. When the Pendant is connected to the Power Supply, the data stored in the Power Supply memory is displayed on the Monitor Panel. When the data is changed and the **ENTER** key is pressed, the contents of the memory of the Power Supply are overwritten by the new setting.



NOTE: The **Pendant** stores data for only one **IS-800CA/1400CA** unit. When two or more the Power Supply units are used and the contents of the memory of the first unit need to be copied to the second unit, copy the data from the first unit to the memory of the Pendant temporarily, then copy this data to the second unit.



Move the cursor ▲▼◀▶to the required item then press the ENTER key; the data will be copied.

a. **IS-800CA (IS-1400CA) → MA-660A.** The data in IS-800CA/1400CA is copied to MEMORY of MA-660A. When copy is complete, **<END>** is displayed.

b. **IS-800CA (IS-1400CA) ← MA-660A.** The data in MEMORY of MA-660A is copied to IS-800CA/1400CA. When copy is complete, **<END>** is displayed.

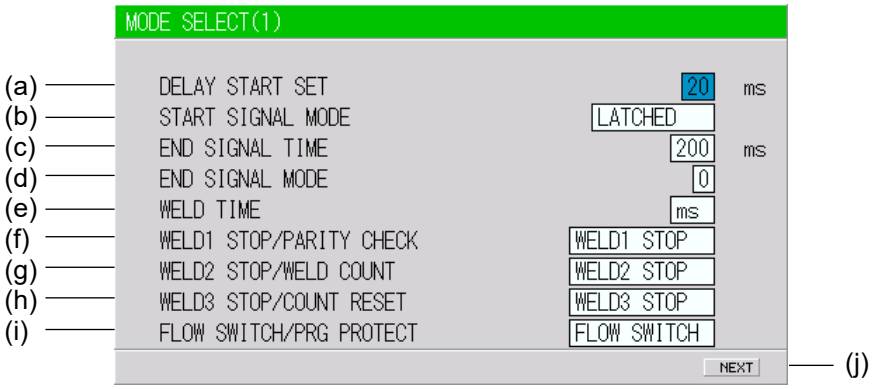
c. **SCHEDULE [A]→ SCHEDULE [B]–[C].** This function is used to copy the SCHEDULE (welding condition). The Power Supply can set up to 255 schedules, indicated as SCHEDULE #1–#255. This function is also used to change from the SCHEDULE #1 setting, to perform welding according to another schedule.

EXAMPLES:

- **Schedule #2** can be set by switching from **SCHEDULE #1** as follows:
  - **SCHEDULE 001→ SCHEDULE 002–002.** Be sure to press the **ENTER** key before moving the cursor).
  - Move the cursor to the left of the letters of **SCHEDULE** and press the **ENTER** key. The data for **SCHEDULE #1** is copied to **SCHEDULE #2** through this operation. Call up #2 on the **SCHEDULE screen**, and change the values, if necessary.
- **SCHEDULE #1** can be copied immediately to **SCHEDULE #2** via **SCHEDULE #4** through the following setting:
  - **SCHEDULE 001 -----> SCHEDULE 002 - 004**

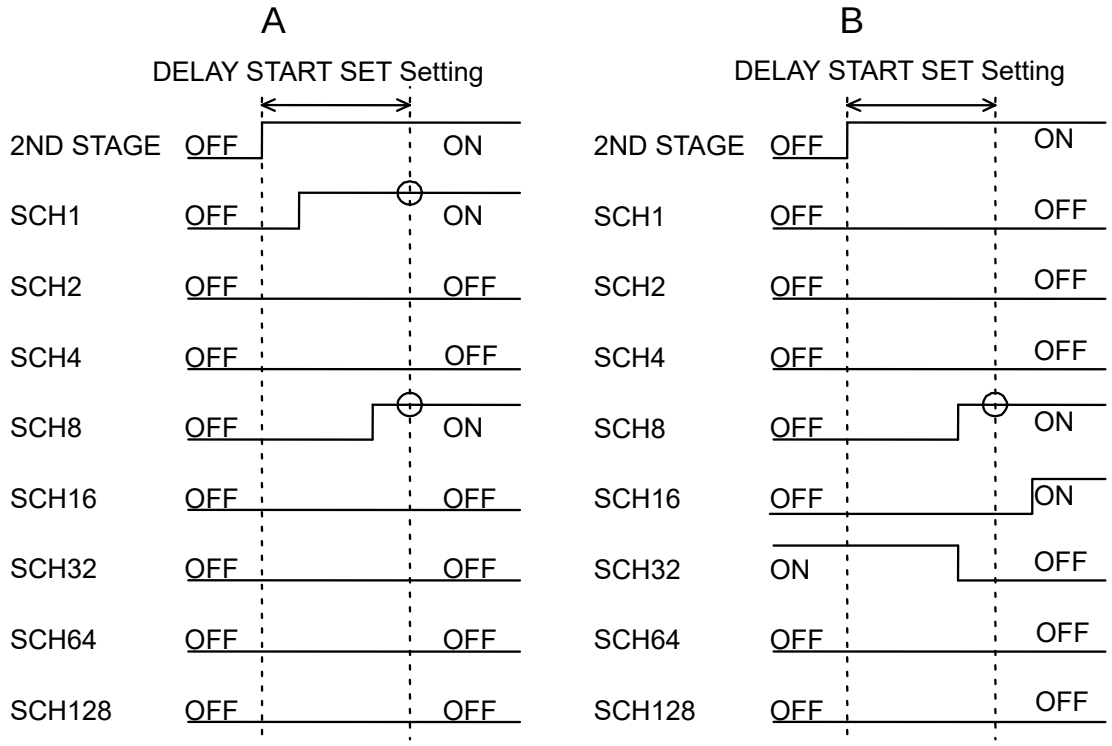
NOTE: Do ***not*** operate the Pendant until the copy is complete.

9. MODE SELECT Screen



a. DELAY START SET

One welding condition is determined via **DELAY START SET**, a value corresponding to chatter prevention time, after a start signal is input. The **DELAY START SET** period can be set in a range from 1 to 20 ms, in unit of 1 ms.



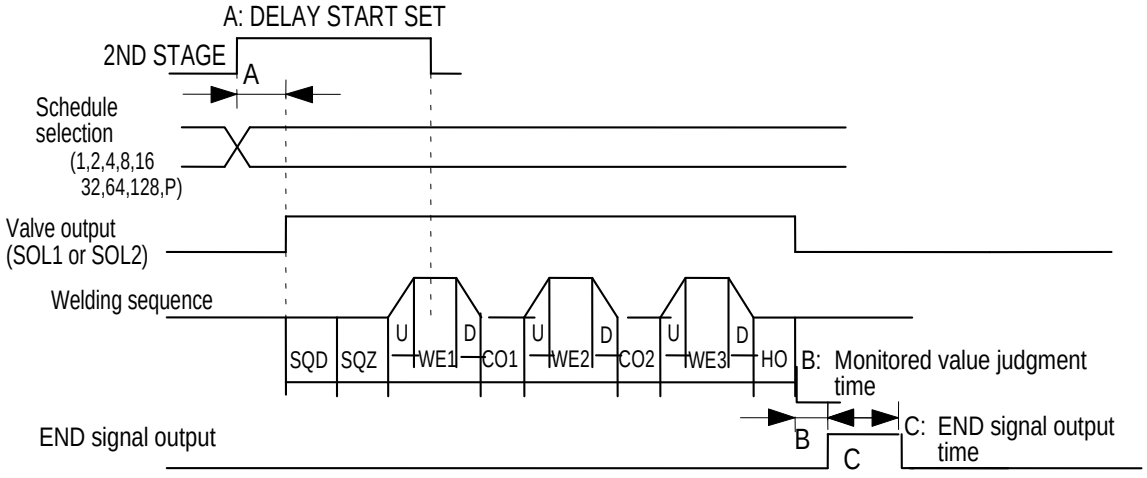
In Figure A above, the schedule signals 1 and 8 are ON. Therefore, welding is performed using schedule number. 9. In Figure B above, only schedule signal 8 is ON. As a result, welding is performed using schedule number 8. Schedule signals 16 and 32 are invalid because they are OFF when the schedule is determined.

NOTE: When **DELAY START SET** is 1 ms or 2 ms, the schedule number when the **2ND STAGE** signal is received is selected. Therefore, in Fig. (A) above, the schedule number is not selected and the schedule signal input error occurs. When **DELAY START SET** is **1** ms or **2** ms, input the schedule signal in advance before the **2ND STAGE** signal is received.

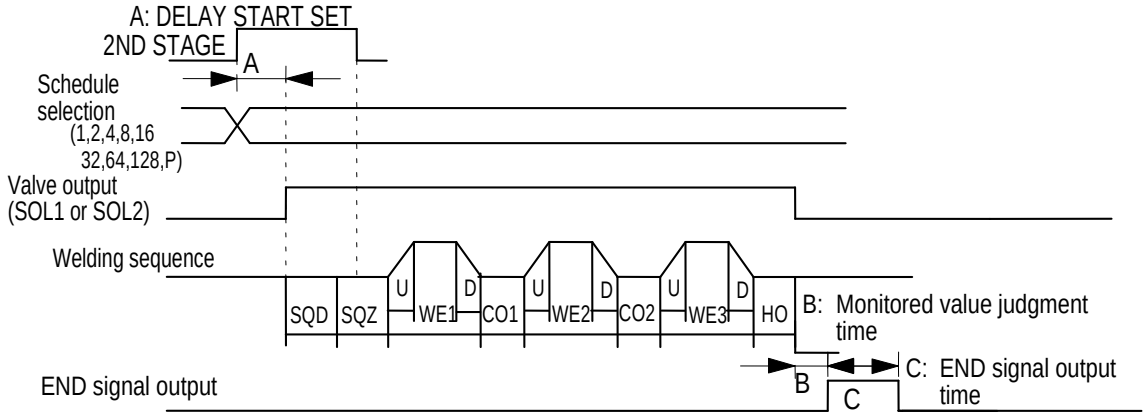
b. START SIGNAL MODE

Set the input method of the start signal to activate the Power Supply.

- **WHEN LATCHED.** The welding sequence halts if the **2ND STAGE** signal stops during squeeze time (SQZ). The welding sequence proceeds to completion when the **2ND STAGE** signal stops during Weld 1 time (WE1) or later.

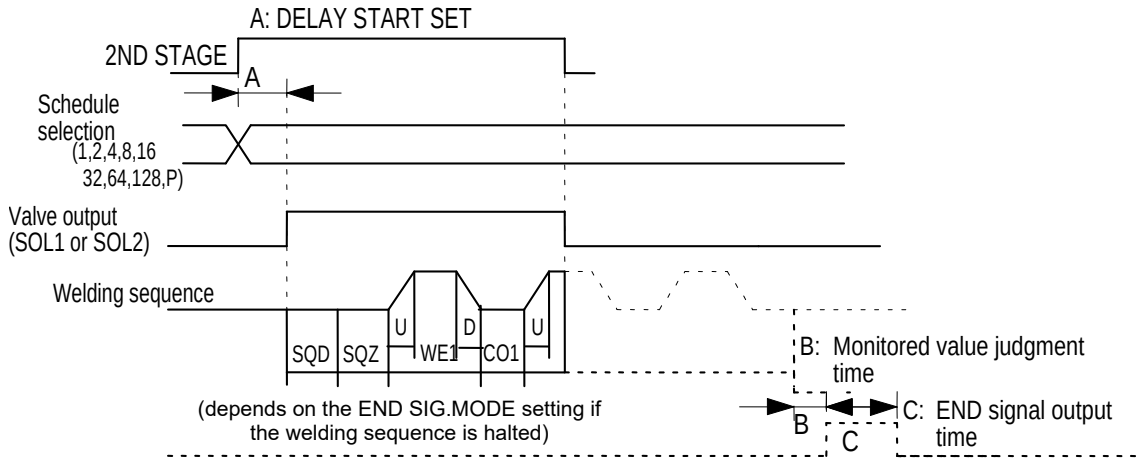


- **WHEN PULSED.** When the **2ND STAGE** signal is input for more than the time set through **DELAY START SET** and then stops, the welding sequence will proceed to completion.



- **WHEN MAINTAINED.** If the **2ND STAGE** signal stops halfway through the welding sequence (from the beginning of initial squeeze delay time through the end of hold time), the welding sequence will halt at that point.

  NOTE: The **END** signal depends on the **END SIG.MODE** setting.



c. END SIGNAL TIME.

Set the length of time for output of the end signal. The output time can be set in a range from 10 to 200 ms and in units of 10 ms. Setting 0ms switches to **HOLD** and maintains the end signal output during the start input. When **OFF** is set, actually output **END** time changes depending on the **OFF** setting even if a value is set for **END SIG.TIME** (see below). Also, this is not output depending on the **END SIGNAL MODE** setting.

EXAMPLE: END SIGNAL TIME is 0 ms

1) OFF is 0 ms (OFF time = 0 ms)
   a) When the start input time is longer than the sequence time, the end signal time is the start input time (Sequence time ≤ start input time → **END** time = start input time)
   b) When the start input time is shorter than the sequence time, the end signal time is the 10 ms. Sequence time > start input time → **END** time = 10 ms)
2) OFF time is 10 ms to 200 ms (10ms ≤ **OFF** time ≤ 200 ms). End signal time is the set **OFF** time (**END** time = **OFF** time).
3) OFF time is 200 ms or more (**OFF** time > 200 ms). End signal time is the 200 ms. (**END** time = 200 ms).

EXAMPLE: END SIGNAL TIME is 10 to 200 ms

1) **OFF** is 0 ms (**OFF** time = 0 ms). End signal time is the set **END SIG.TIME** time. (**END** time = **END SIG.TIME** time).

2) **OFF** time is set (10 ms ≤ OFF time)
   a) **END SIG.TIME** time is shorter than **OFF** time (**END SIG.TIME** time <**OFF** time) End signal time is the set **END SIG.TIME** time. (**END** time = **END SIG.TIME** time).
   b) OFF time is longer than **END SIG.TIME** time (**END SIG.TIME** time ≥ **OFF** time) End signal time is the **OFF** time. (**END** time = **OFF** time)

d. END SIGNAL MODE

Set the conditions for output of the end signal upon completion of the weld sequence.

0. Outputs the end signal even when the monitored value is outside the upper and lower tolerance limits. The end signal will not be output in the event of an error or when the sequence is interrupted by **START SIGNAL MODE (MAINTAINED).**
1. The end signal will not be output when the monitored value is outside the upper and lower tolerance limits(*****), in the event of an error, or when the sequence is interrupted by **START SIG.MODE (MAINTAINED)**.
2. The end signal will be output even when the monitored value is outside the upper and lower tolerance limits(*), even in the event of an error, and even when the sequence is interrupted by **START SIGMODE (MAINTAINED).**

NOTE: There is no distinction between **ERROR** and **CAUTION**.

END signal output

END SIG. MODE	NORMAL	COUNT-RELATED ERROR	UPPER/LOWER LIMIT ERROR	OTHER ERRORS AT WELDING	STOPPED HALFWAY (MAINTAINED)
0	Output	Output	Output	No output	No output
1	Output	Output	No output	No output	No output
2	Output	Output	Output	Output	Output

NOTE: For faults, see the Fault Code List. Priority is "Stopped halfway" = "Other errors at welding" > "Upper/lower limit error" > "Count-related error".

e. WELD TIME

Use this setting to change the units for time settings available on the **SCHEDULE screen**.

CYC	50 Hz: 1CYC = 20 ms 60 Hz: 1CYC = 16.6 ms
ms	—

f. WELD1 STOP / PARITY CHECK.

Set external input pin 13.

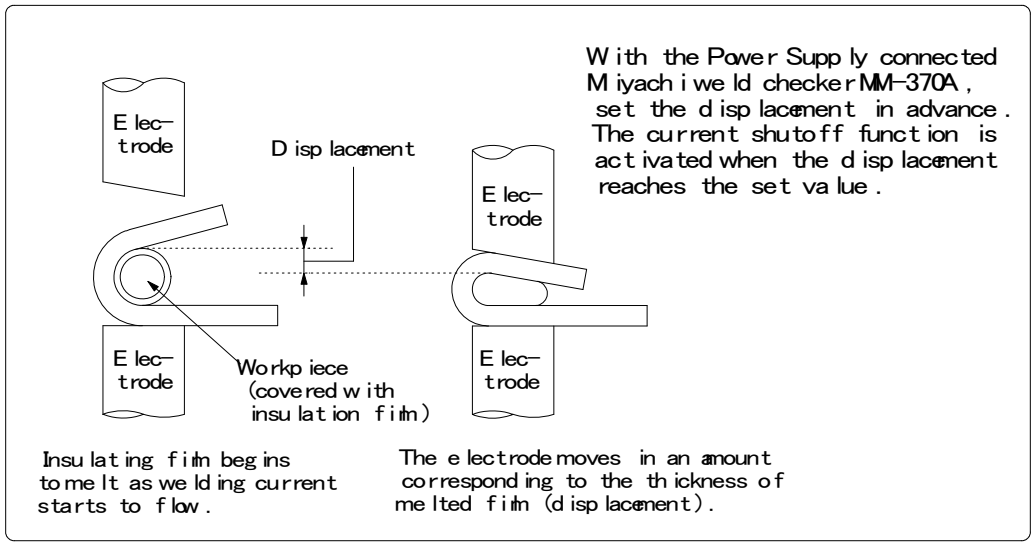
- When **WELD1 STOP** is selected. Parity check will not be performed. The sequence will proceed to COOL1 if external input pin 13 is closed during the **WELD1** sequence operation. (Refer to Note 2, "Current shutoff function.")
- When **PARITY CHECK** is selected. Parity check will be performed. This check allows for detection of a failure resulting from a wire break in the schedule selection signal lines. Be sure that the total number of closed schedule selection and parity signal lines is always odd. (Refer to Note 1, "Schedule Numbers and Schedule Selection Pins.")

NOTE: Schedule Numbers and Schedule Selection Pins

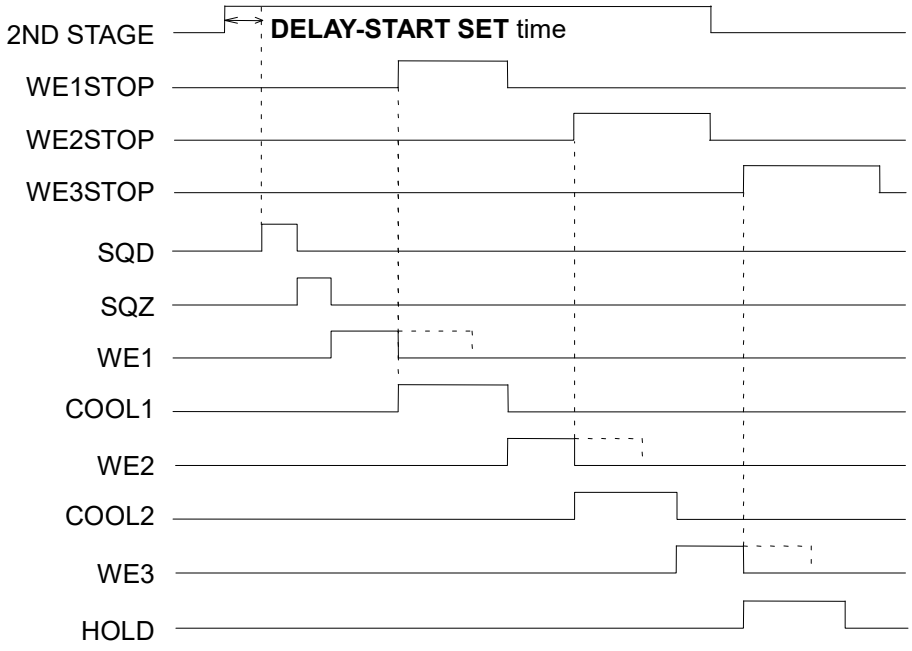
●: Closed Blank: Open

SCHEDULE #	SCH 1	SCH 2	SCH 4	SCH 8	SCH 16	SCH 32	SCH 64	SCH 128	PARITY
1	●								
2		●							
3	●	●							●
4			●						
5	●		●						●
6		●	●						●
7	●	●	●						
8				●					
9	●			●					●
10		●		●					●
11	●	●		●					
12			●	●					●
13	●		●	●					
⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮	⋮ ⋮
247	●	●	●		●	●	●	●	
248				●	●	●	●	●	
249	●			●	●	●	●	●	●
250		●		●	●	●	●	●	●
251	●	●		●	●	●	●	●	
252			●	●	●	●	●	●	●
253	●		●	●	●	●	●	●	
254		●	●	●	●	●	●	●	
255	●	●	●	●	●	●	●	●	●

NOTE: Current shutoff function. The current shutoff function shuts off current when the proper weld penetration is achieved for example, during fusing thus preventing excessive penetration. (Refer to the figure below)



Timing chart for stopping current



The **WE1STOP** signal shuts off current immediately when input during the **WE1** period, switching the sequence to **COOL1**. The **WE1STOP** signal shuts off current immediately after the **WE1** starts (the current is supplied for about 1 cycle) when input before the **WE1** period, switching the sequence to **COOL1**. The **WE1STOP** signal will not shut off current if input during the **WE2** or **WE3** period.

The **WE2STOP** signal shuts off current immediately when input during the **WE2** period, switching the sequence to **COOL2**. The **WE2STOP** signal shuts off current immediately after the **WE2** starts (the current is supplied for about 1 cycle) when input before the **WE2** period, switching the sequence to **COOL2**. The **WE2STOP** signal will not shut off current if input during the **WE3** period.

The **WE3STOP** signal shuts off current immediately when input during the **WE3** period, switching the sequence to **HOLD**. The **WE3STOP** signal shuts off current immediately after the **WE3** starts (the current is supplied for about 1 cycle) when input before the **WE3** period, switching the sequence to **HOLD**.

When the welding stop signal is input before the start signal is received, the welding stop error occurs.

When **WELD STOP OFF TIME** is set, the current is supplied for the time period in **WE1/2/3**.

This weld time is the **WELD** repetition time except for the **INT** time.

EXAMPLE: When **WELD STOP OFF TIME: 60 ms**, **WELD: 15ms**, **INT: 10 ms**, and repetition: **3**, the total time is 75 ms. The welding current is supplied for at least 60 ms and neglected for 15ms (**WELD: 5 ms** + **INT: 10 ms**). This is also effective when the off time (**OFF**) is set. Welding is stopped when the signal is input before each **WE**. Welding is performed when the signal is released before each **WE**.

g. WELD2 STOP / WELD COUNT

Set external input to pin 14. When **WELD2 STOP** is selected the weld count will not be checked. The sequence will proceed to **COOL2** if external input pin 14 is closed during the **WELD2** sequence operation. When the **WELD2 STOP** signal is input before the start signal is input even if the **WELD1** is set, the welding stop error occurs. When **WELD COUNT** is selected the weld count will be checked.

h. WELD3 STOP / COUNT RESET

Set external input to pin 25. When **WELD3 STOP** is selected the count will not be reset. The sequence will proceed to **HOLD** if external input pin 25 is closed during the **WELD3** sequence operation. When the **WELD3 STOP** signal is input before the start signal is input even if the **WELD1** or the **WELD2** is set, the welding stop error occurs. When **COUNT RESET** is selected the count will be reset.

i. FLOW SWITCH / PRG PROTECT

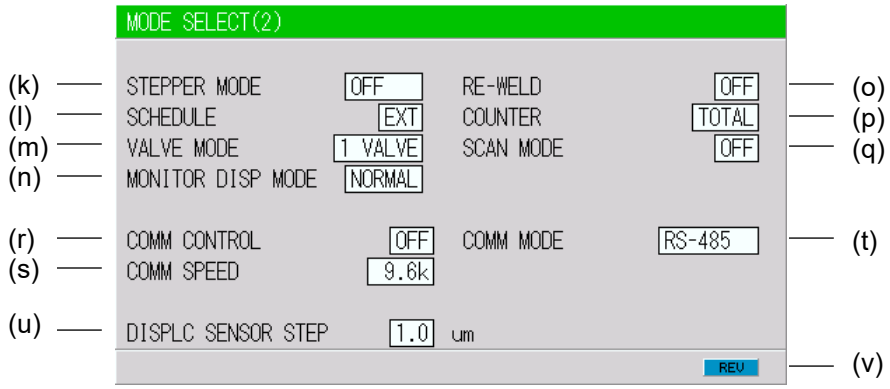
Set external input pin 21.

When **FLOW SWITCH** is selected
Flow switch input pin. Opening this pin will result in a flow rate error.

When **PRG PROTECT** is selected
Program inhibit input pin. Closing this pin will not allow you to change the settings.

j. NEXT

When the cursor () is displayed, pressing the **ENTER** key will change the display to the MODE SELECT (2) screen.



k. STEPPER MODE

Select whether or not to perform step-up (step-down) operation, refer to the **STEPPER COUNT** Screen.

OFF	Step-up (step-down) will not be performed.
FIXED	Step-up (step-down) will be performed. (Stepwise)
LINER	Step-up (step-down) will be performed. (Linear)

NOTE: RATIO has an effect on **HEAT** only. Fixed for **UF/DL**. When the **HEAT** value multiplied by **RATIO** falls below the **UF/DL** value, an error occurs.

The **COUNT** value works as each **STEP** value. **Example: STEP1 0020 STEP2 0010** indicates that **STEP1** is 20 times and **STEP2** is 10 times. The conditions for stepper count-up is the same as the **TOTAL** counter.

l. SCHEDULE

Sets the selection method of schedule number.

EXT	Selects the schedule number by binary of the I/O terminal strip.
INT	Selects the schedule number by the SCHEDULE number of **the Pendant**. (Note)

NOTE: When setting SCHEDULE to INT, be sure to connect **the Pendant** and select the SCHEDULE screen or the MONITOR screen.

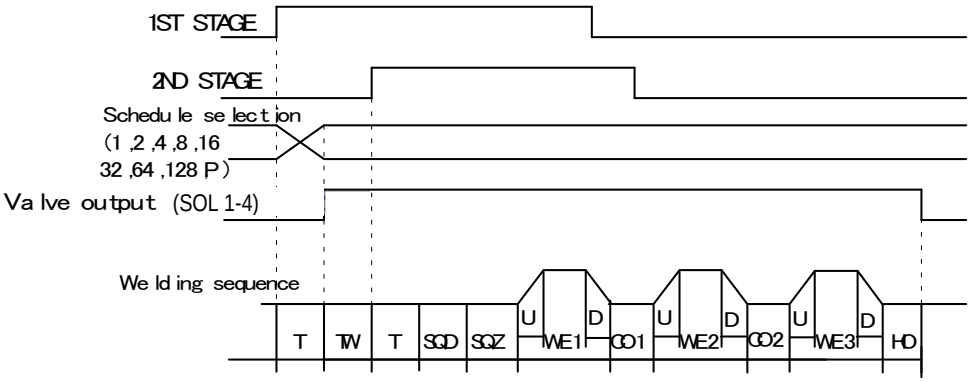
m. VALVE MODE (Advanced Models ONLY)

Select the output method (1 VALVE or 2 VALVE) of the solenoid valve signal.

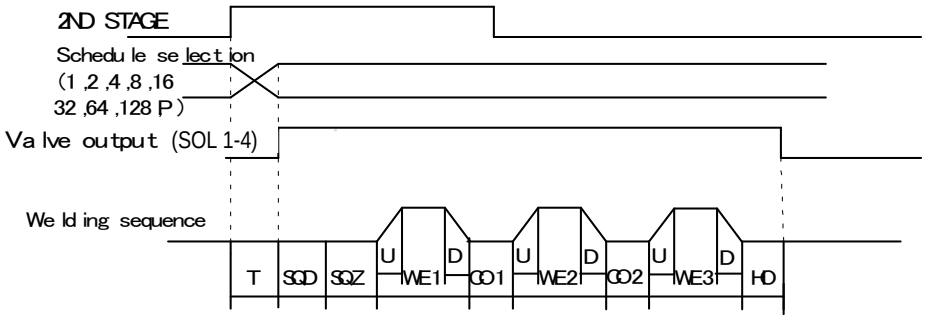
When **1 VALVE** is selected

When the 1ST STAGE signal is input, the valve signal (SOL1 - 4) with the selected schedule number is output and the sequence waits for the 2ND STAGE signal input. Next, when the 2ND STAGE signal is input, the welding sequence with the selected schedule number starts. After the welding sequence starts, the valve signal is output until the sequence ends even if the 1ST STAGE signal is turned OFF.

T: DELAY START SET (1 to 20 ms)
TW: 2ND STAGE signal input wait time (uncertain)



When the 2ND STAGE signal is input, the valve signal (SOL1 or SOL2) with the selected schedule number is output. After the welding sequence starts, the valve signal is output until the sequence ends even if the 2ND STAGE is turned OFF.

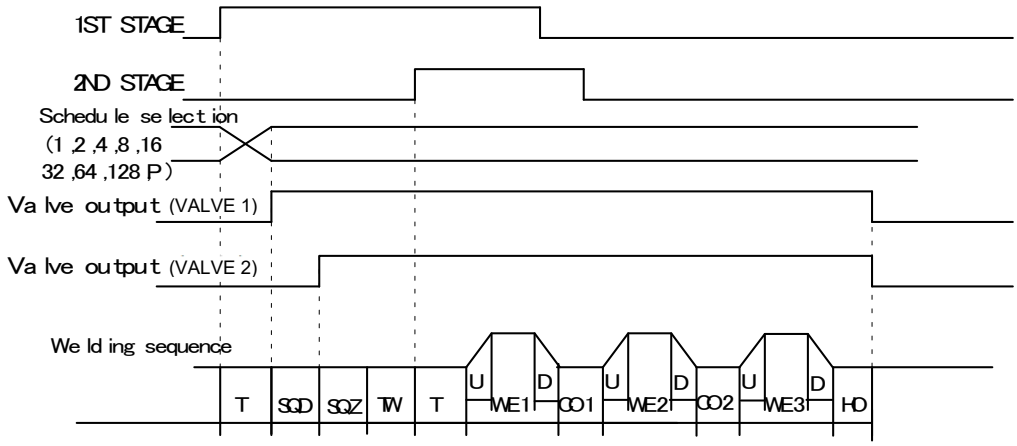


When **2 VALVE** is selected

2 valve signals (VALVE 1, 2) are output in a sequence. When VALVE 1 is used, the weld force position can be adjusted by the 1ST STAGE signal output timing of VALVE 2 to the start of SQZ. After the welding sequence starts, the valve signal is output until the sequence ends even if the 1ST STAGE signal is turned OFF. When VALVE MODE is set to 2 VALVE, the following functions become disabled.

・OFF (repeated operation)
・STEPPER (step-up (-down) operation)

When the 1ST STAGE signal is input, VALVE 1 is output, and then SOL2 is output after SQD. After SQD and SQZ, the sequence waits for the 2ND STAGE signal input. Next, when the 2ND STAGE signal is input, the welding sequence after WELD1 starts.



n. MONITOR DISP MODE

Sets the monitor display. This function is invalid when the Pendant is disconnected.

NORMAL	The monitor display is updated each time. It takes monitored value computing time + display time (ms). Used when the part cycle time is relatively slow. * Communicated with the Pendant each time welding is complete.
LAST	The monitor display is not updated. When the MONITOR screen is updated, the last measured value is displayed. Used when the part cycle time is relatively fast. Errors are also displayed only when updated (communicated with the Pendant). * Not communicated with the Pendant automatically.

o. RE-WELD

Select whether or not to supply welding current again at the same location if the monitored current is lower than the lower limit. The second welding current will be 5% greater than the setting value.

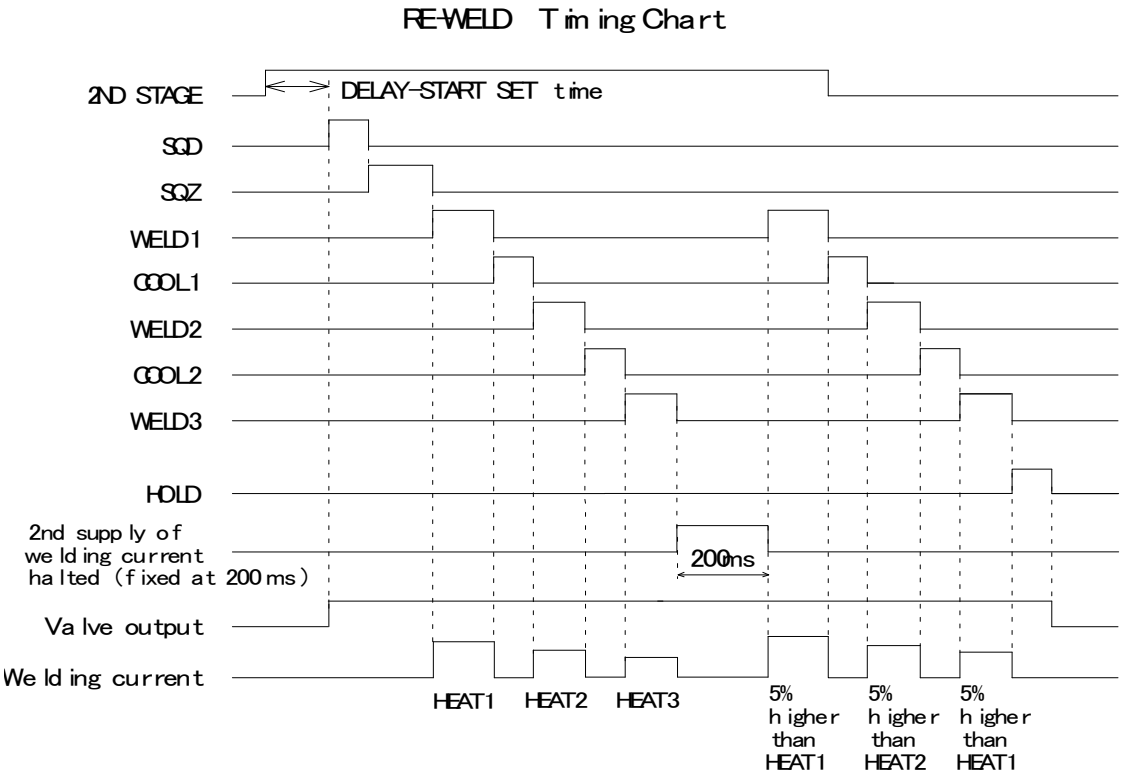
ON	Welding current will be supplied again.
OFF	Welding current will not be supplied again.

Even when the welding current is supplied twice with RE-ELD, each count-up is done only once.

TOTAL, **WELD/WORK**, and **STEPPER** → Once

GOOD→ None (below the lower limit setting for the second time). Once (the lower limit setting or more for the second time). This cannot be used in combination with the off time (OFF).

When the off time is set, **RE-WELD** works as **OFF** even if **ON**. When **RE-WELD** is combined with **STEPPER**, the welding current will be 5% greater than the value set for **STEPPER**.



p. COUNTER

Sets the mode of counter. There are three modes (**TOTAL/GOOD/WORK**). The counter value returns to "0" at the time the setting is changed. Count-up is done in all cases only when **WELD** is **ON**.

TOTAL: Count-up (increment of +1) is done despite the result of the upper/lower limit judgment in monitoring when the current is supplied.

In case of errors other than upper/lower limit monitor and counter error (device error, setting error, no-current error (**ERROR/CAUTION**), work piece error (**ERROR/CAUTION**)), count-up is not done. When the welding is interrupted, count-up is not done.

Judgment in Monitor		Counting Manner
GOOD (normal)		Count-up
Upper/lower limit monitor	**CAUTION**	
	ERROR	
Error / Interrupt		No Count-up

GOOD: Count-up is done if the judgment is **GOOD** in current-supplied monitoring. In case of errors other than the counter error, count-up is not done. Also, when the welding is interrupted, count-up is not done.

Judgment in Monitor		Counting Manner
GOOD (normal)		Count-up
Upper/lower limit monitor	CAUTION	No Count-up
	ERROR	
Error / Interrupt		

WORK: Count-up is not done if the judgment is **ERROR** in current-supplied monitoring.

Judgment in Monitor		Counting Manner
GOOD (normal)		WELD Counter counts-up. WORK Counter counts-up (increment of+1) when WELD Count reached the set value.
Upper/lower limit monitor	CAUTION	
	ERROR	WELD Counter does not count-up. WELD Counter is reset to 0 (zero) when NG is reset. WORK Counter does not count-up.
Error		
Interrupt		WELD Counter does not count-up. Since an error does not occur, the error reset is not received.

q. SCAN MODE

Cannot be used. Select OFF.

r. COMM CONTROL

Selects a communication function.

OFF	No communication
→	One-way communication
↔	Both-way communication

s. COMM MODE

Selects a communication mode.

RS-485 (optional)	Communication by RS-485
RS-232C	Communication by RS-232C

t. COMM SPEED

Selects a communication speed.

9.6k	Communication at 9,600 bps
19.2k	Communication at 19,200 bps
38.4k	Communication at 38,400 bps

For details of the external communication, see **External Communication Function**.

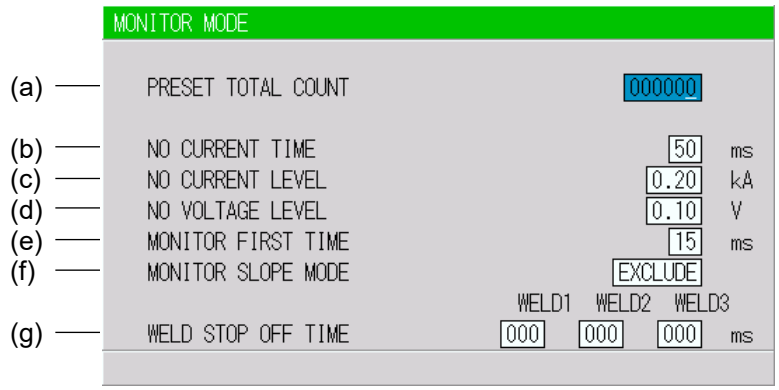
u. DISPLC SENSOR STEP

Sets the resolution of displacement sensor.
(Example) **LGK-110**: 1.0 µm

v. REV

When the cursor () is displayed, pressing the **ENTER** key will change the display to the MODE SELECT (1) screen.

10. MONITOR MODE Screen

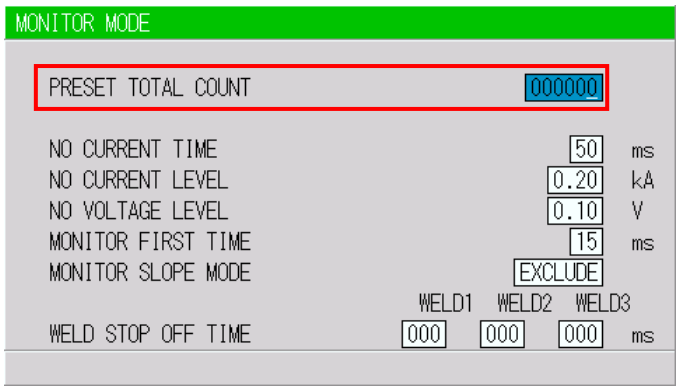


NOTE: This screen shows initial settings. The display surrounded with frame changes depending on the setting of **WELD2 STOP/WELD COUNT** and **COUNTER** on the **MODE SELECT** screen.

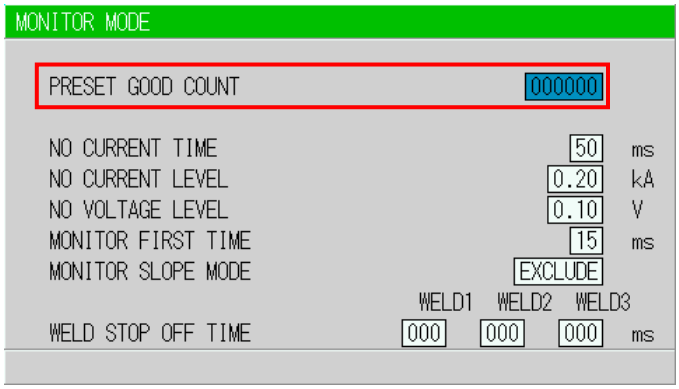
a. PRESET TOTAL COUNT

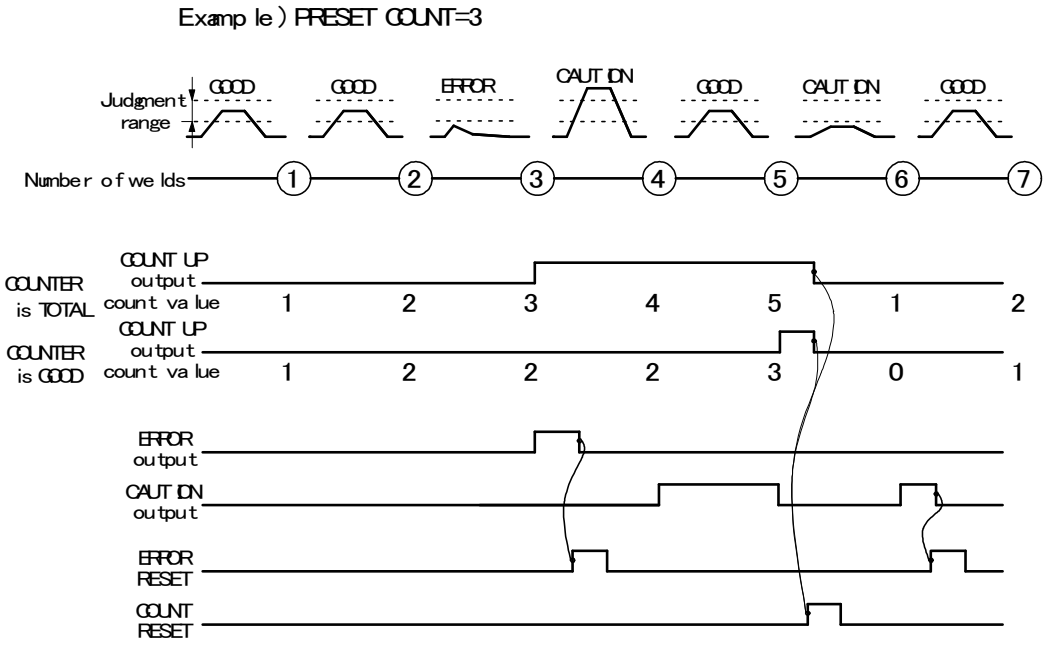
The display changes depending on the setting of WELD2 STOP/WELD COUNT and COUNTER on the MODE SELECT screen. The preset count is the count value set in advance. When each count reaches the set value, E-28 (Count-up) is displayed and the **COUNT UP** signal is output.

When WELD2 STOP/WELD COUNT is WELD2 STOP and COUNTER is TOTAL, the PRESET TOTAL COUNT is displayed.



When WELD2 STOP/WELD COUNT is WELD2 STOP and COUNTER is GOOD, the PRESET GOOD COUNT is displayed.



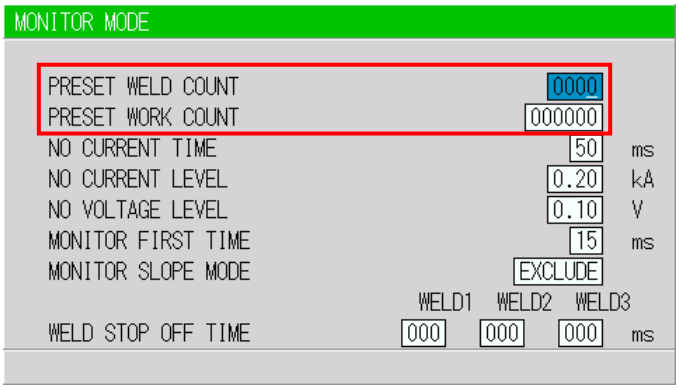


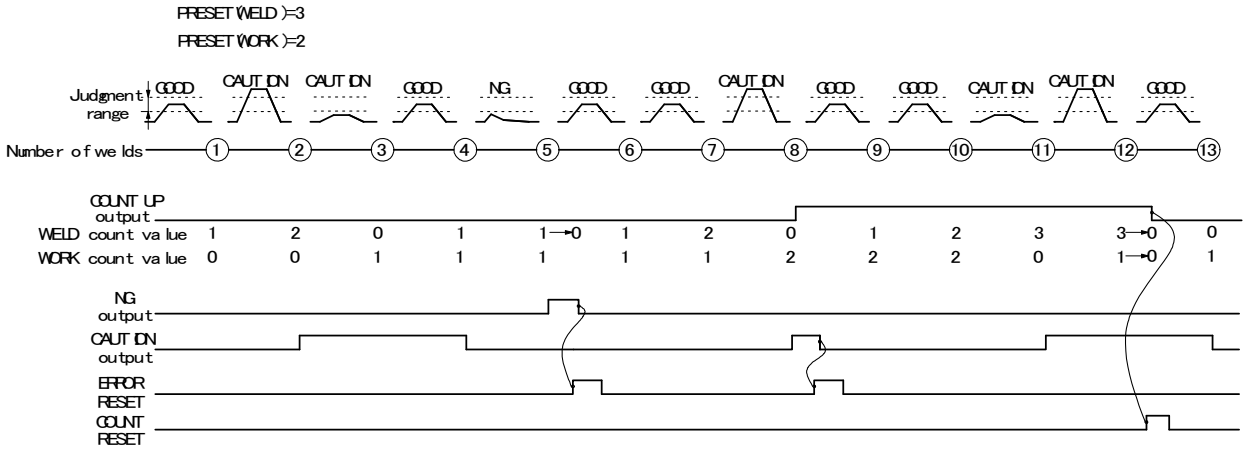
NOTES:

- When ERROR RESET is input, display of **the Pendant**, **TROUBLE** lamp on panel and ERROR/CAUTION output are turned OFF, but COUNT UP output is not turned OFF.
- When COUNT RESET is input, display of **the Pendant**, **TROUBLE** lamp on panel and COUNT UP output are turned OFF, but CAUTION output is not turned OFF.
- The chart above represents the occasion where ERROR/CAUTION output is set to N.O. (NORMAL OPEN): Open at normal / Closed at error.

- **WELD2 STOP/WELD COUNT is WELD2 STOP and COUNTER is WORK**

  Set WELD COUNT and WORK COUNT. When PRESET WELD COUNT is set to 0, the weld count is not incremented. Also, when the PRESET WORK COUNT is set to 0, count-up is not done.

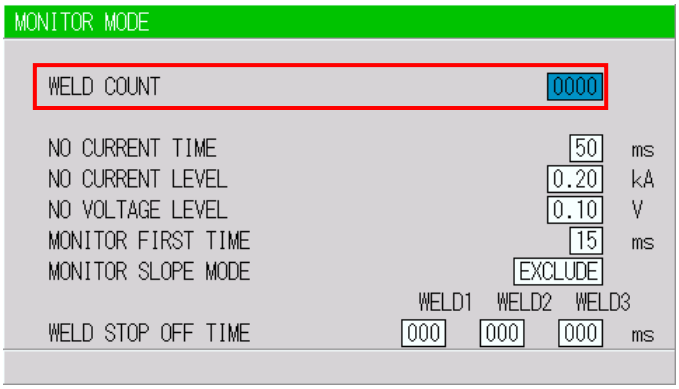




NOTES:

- The **WELD** count becomes "0" at the same time as the **WORK** count is increased by +1, not "3" (**PRESET COUNT** value).
- When **ERROR RESET** is input, display of the Pendant, **TROUBLE** lamp on panel and **NG/CAUTION** output are turned **OFF**, but **COUNT UP** output is not turned **OFF**.
- When **COUNT RESET** is input, display of the Pendant, **TROUBLE** lamp on panel and **COUNT UP** output are turned **OFF**, but **CAUTION** output is not turned **OFF**.
- The chart above represents the occasion where **NG/CAUTION** output is set to **N.O. (NORMAL OPEN)**: Open at normal / Closed at error.

- **WELD2 STOP/WELD COUNT is WELD COUNT**

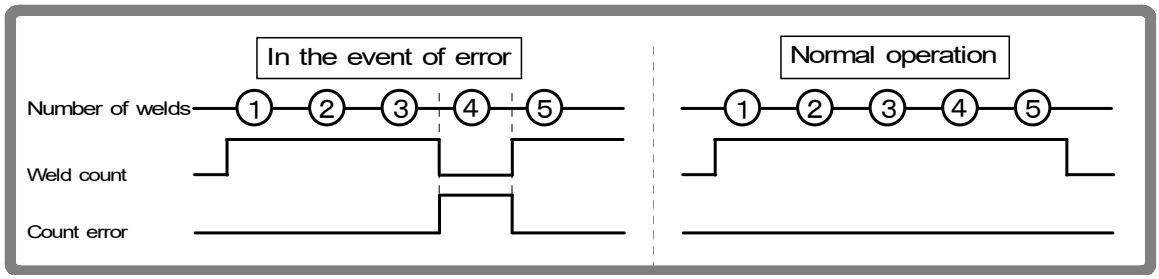


A count error signal is output if the number of welds deposited while the external weld count signal is input is smaller than the value set for **PRESET COUNT** (weld count signal is turned off before the number of welds set for **PRESET COUNT** is not deposited). See the following diagram.

For example, if you set the number of welds to 5 from the programmable logic controller, select "**5**" for **PRESET COUNT** as well.

This function can be turned on or off through **WELD2 STOP/WELD COUNT** on the **MODE SELECT** screen. To clear the count error signal, you need to input the weld count signal again or add required number of welds to make up for insufficiency. The count error signal is not cleared if the error reset signal is input. Also, when required number of welds are added to make up for insufficiency, the count error signal is output until the insufficient number of welds is complete.

NOTE: **OFF/Off** time and **WELD COUNT** do not work simultaneously. When **WELD COUNT** is set, OFF is invalid.



b. NO CURRENT TIME

The absence of welding current will not be detected as a no-current or no-voltage error (see *Chapter 5, Troubleshooting*) as long as the absence lasts for a period within the time set here.

For example, if you select 3 ms, the absence of current will not be detected as an error as long as it lasts no more than 3 ms. An absence of current will be detected as an error if it lasts for 4 ms or more.

At this time, the **TROUBLE** lamp lights up. When the Pendant is connected, the fault code is displayed on the monitor. **COOL**, **HOLD**, **OFF**, and **INT** times are not included in the time for the no-current to be detected.

c. NO CURRENT LEVEL / d. NO VOLTAGE LEVEL

Set the current or voltage level for determining the absence of current or voltage as a no-current or no-voltage error. The **TROUBLE** lamp will light up, and operation will stop if the monitored current or voltage falls below the level set here.

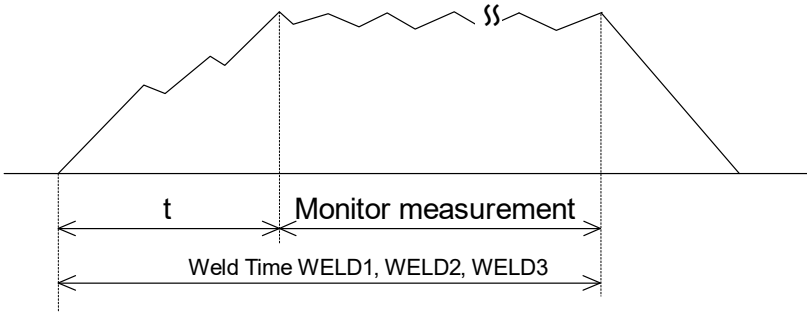
In the case of primary current control, supplying current with the welding transformer's secondary side open will cause an excitation current to flow through the primary side. Set the current level slightly higher than the monitored current.

NOTE: No judgment as to no-current or no-voltage error will be made if you select **00.0kA/0.00 V**. If the toroidal coil and the voltage detecting cable are disconnected in the second control, excessive current may flow.

e. MONITOR FIRST TIME

Use this setting to specify the start time to measure the monitored value (current, voltage, power, pulse width). The start time can be set in a range from 0 to 15 ms. Use this setting to exclude the initial rise of current from measurement.

The monitored value will not be displayed if the weld time is shorter than **MONITOR FIRST TIME**. The monitored value will not be also checked against the upper and lower tolerance limits.



t = MONITOR FIRST TIME

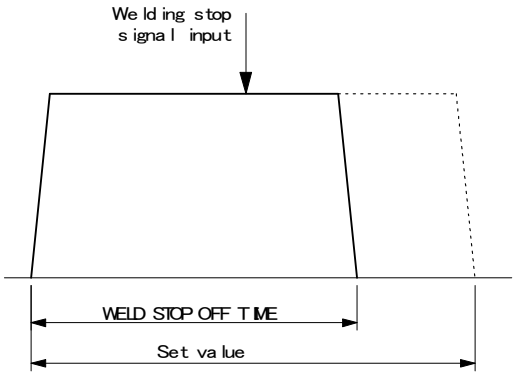
f. MONITOR SLOPE MODE

Select whether or not to include a slope period in the monitored value to be displayed.

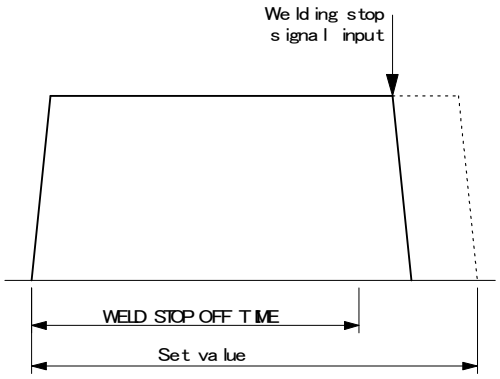
EXCLUDE	Slope period will not be included.
INCLUDE	Slope period will be included.

g. WELD STOP OFF TIME

Sets the neglecting time of the welding stop signal for each of **WELD1**, **WELD2** and **WELD3**. Even if the welding stop signal is input during welding, the current is supplied for the set time and the sequence will switch to the next. When the welding stop signal is input within WELD STOP OFF TIME. The welding is stopped at the end of WELD STOP OFF TIME.

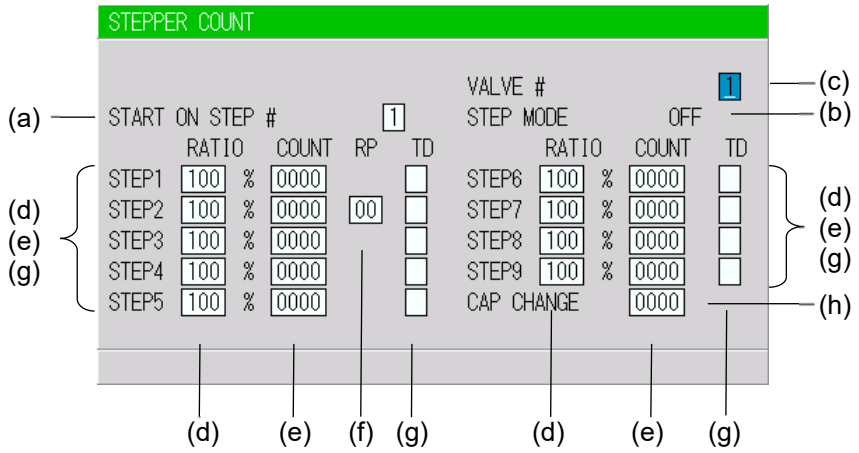


When the welding stop signal is input after WELD STOP OFF TIME
The welding is stopped when the welding stop signal is input.



11. STEPPER COUNT Screen

The Power Supply can change the level of the welding current depending on the welding conditions. The function to increase the welding current is called the “step-up” function, and that to decrease the welding current is called the “step-down” function. Set the step-up or step-down timing based on the number of welds. When the set number of welds is complete, the step end signal (**STEP END**) is output.



a. START ON STEP

The counting of welds starts from the **STEP** set here.

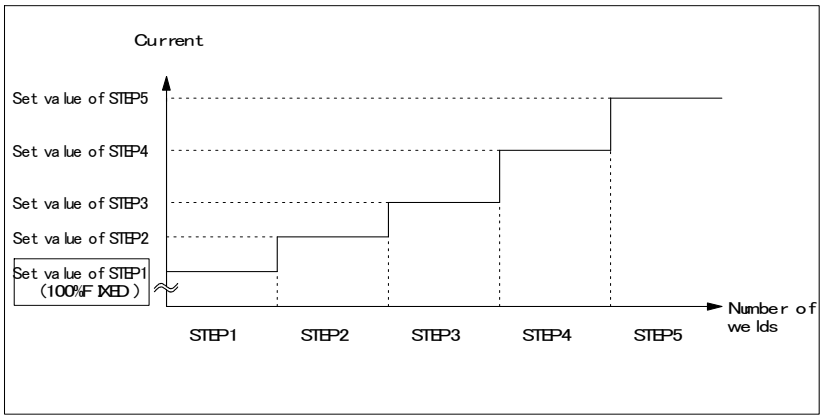
If, for example, you select **START ON STEP #3** as shown above, welds will be counted from the first weld in **STEP3**, even if welding for the first time. Further, the welding current will be increased (or reduced) by the extent you have set this value for **STEP3**.

Set the desired **STEP** No. 1–9 for **VALVE1** and **VALVE2, or SOL 1 – 4,** respectively, depending on the valve mode selection.

b. STEP MODE

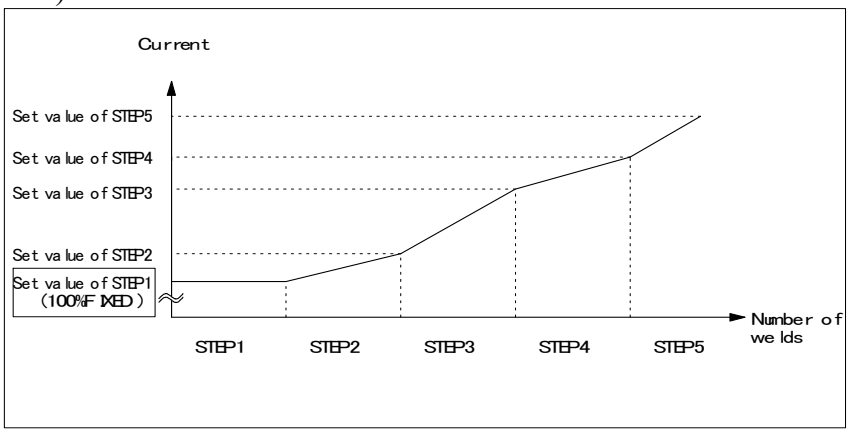
There are two types for step-up (step-down), stepwise (**FIXED**) and linear (**LINER**). When step-up (step-down) is not used, **OFF** is displayed. The setting is made on the **MODE SELECT** screen.

FIXED



As shown in the above figure, the current is stepped up or down to the value for **STEP2** following completion of the specified number of welds for **STEP1**. Similarly, the current is stepped up or down to the value for **STEP3** following completion of the specified number of welds for **STEP2**.

LINER (linear)



As shown in the above figure, the current is stepped up or down to the value for **STEP2** with the specified number of welds for **STEP2** following completion of the specified number of welds for **STEP1**. Similarly, the current is stepped up or down to the value for STEP3 the specified number of welds for **STEP3** following completion of the specified number of welds for STEP2.

For example, the settings are **COUNT: 2** for **STEP1, RATIO: 200%** and **COUNT: 4** for **STEP2**, and 2 kA for current, the current is stepped up in a stepwise manner from Weld 3 to Weld 6 as shown below.

Weld 1:2 kA Weld 2:2 kA Weld 3:2.5 kA Weld 4:3.0 kA Weld 5:3.5 kA Weld 6:4.0 kA
<--------- STEP1----------> <---------- STEP2 ---------->

START ON STEP #

The counting of welds starts from the **STEP** set here. For example, if you select **START ON STEP #3** as shown above, welds will be counted from the first weld in **STEP3**, even if welding for the first time. Further, the welding current will be increased (or reduced) by the extent you have set this value for **STEP3**. Set the desired **STEP** number. 1 – 9 for **VALVE1** and **VALVE2** respectively.

STEP 1–9. Set the welding current step-up ratio (**RATIO**) and the number of welds (**COUNT**) for each **STEP**. The sequence will proceed to the next **STEP** when the set number of welds is reached.

VALVE # Make settings for (a) and (b) above for each valve number. Change the number to set the schedule for each valve.

NOTE: Upper/Lower limit judgment value when STEPPER MODE is set to ON The upper/lower limit judgment value set here is for the current when a welding is performed, not for the initial setting. Therefore, when STEPPER MODE is set to ON to perform step-up (step-down) for the initial setting, the upper/lower limit judgment value is stepped up or down automatically.

RATIO has an effect on **HEAT** only. Fixed for **UF/DL**. When the **HEAT** value multiplied by **RATIO** falls below the **UF/DL** value, an error occurs.

Example: When the current is set to **2 kA, H; 2.2 kA, L; 1.8 kA**. When the step becomes **150%**, **H** and **L** become as follows.

H: 2.2 x 1.5 = 3.3 kA
L: 1.8 x 1.5 = 2.7 kA

c. VALVE

Make settings for (a) and (b) above for each valve number. Change the number to set the schedule for each valve.

NOTE: Upper/Lower limit judgment value when **STEPPER MODE** is not OFF. The upper/lower limit judgment value set here is for the current when a welding is performed, not for the initial setting.

Therefore, when **STEPPER MODE** is not OFF to perform step-up (-down) for the initial setting, the upper/lower limit judgment value is stepped up or down automatically.

RATIO has an effect on HEAT only. Fixed for UF/DL. When the HEAT value multiplied by RATIO falls below the UF/DL value, an error occurs.

Example: When the current is set to 2 kA, HIGH; 2.2 kA, LOW; 1.8 kA.

When the step becomes 150%, HIGH and LOW become as follows.

HIGH: 2.2 x 1.5 = 3.3 kA
LOW: 1.8 x 1.5 = 2.7 kA

d. STEP 1–9

Set the welding current up (-down) ratio (**RATIO**) for each **STEP**.

e. COUNT 1–9

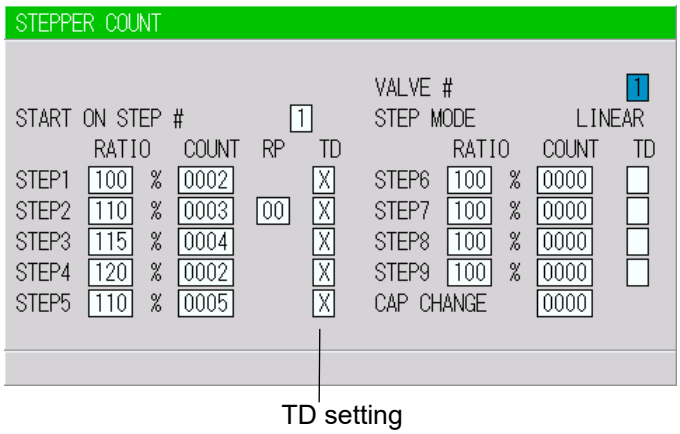
Set the number of welds (**COUNT**) for each **STEP**. The sequence will proceed to the next **STEP** following completion of the specified number of welds.

f. RP2 (Advanced Models ONLY)

Set the number of repetition (**COUNT**) for **STEP2**. The sequence will proceed to the next **STEP3** following completion of the specified number of welds. **STEP2** is repeated the set number of times, and the sequence will proceed to the next **STEP3**.

g. TD 1–9 (Advanced Models ONLY)

Set the chip dress for each **STEP**. When TD is set, X is displayed. For **STEP** with the tip dress setting, the tip dress error occurs following completion of the specified number of welds.



h. CAP CHANGE (Advanced Models ONLY)

Set the cap change (**COUNT**) for **STEP9**.

The cap change error occurs following completion of the specified number of welds for **STEP9**.

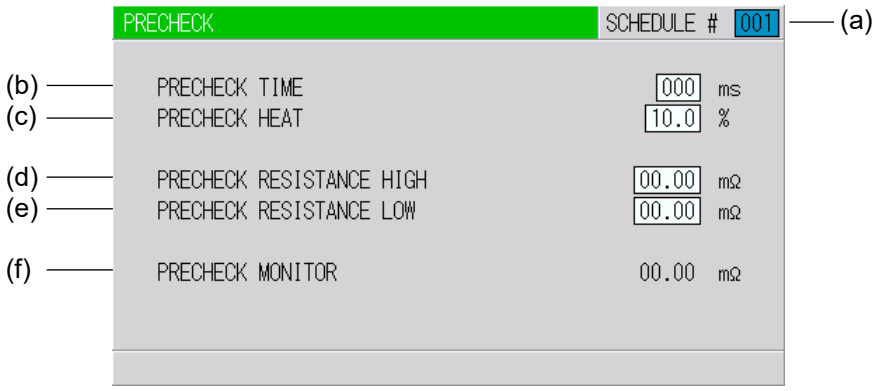
When the number of welds is set in **CAP CHANGE**, prior notice for cap change will be given before the cap change error occurs.

Specify the number of welds to give prior notice how many numbers before the number of welds (**STEP9 COUNT**) that the cap change error occurs.

For example, when **STEP9 COUNT** is 1,000 (the number of welds that the cap change error occurs) and **CAP CHANGE** is 10, prior notice is given when the stepper count is 990.

12. PRECHECK Screen

Screen for setting the weld time and pulse width for resistance pre-check welding. The resistance pre-check welding is a function to apply a small current under constant voltage control before regular welding to confirm that the part to weld is set correctly by means of the measured current value. To use the pre-check function, the secondary current (voltage) needs to be monitored.



a. SCHEDULE

Select from #1 to #255 to set the **SCHEDULE**. Normally select #1 first, then select additional schedules in sequential order.

b. PRECHECK TIME

Set the weld time. Pre-check is not performed at 0 ms.

c. PRECHECK HEAT

Set the welding pulse width.

d. PRECHECK RESISTANCE HIGH

Set the upper limit of resistance value for pre-check.

e. PRECHECK RESISTANCE LOW

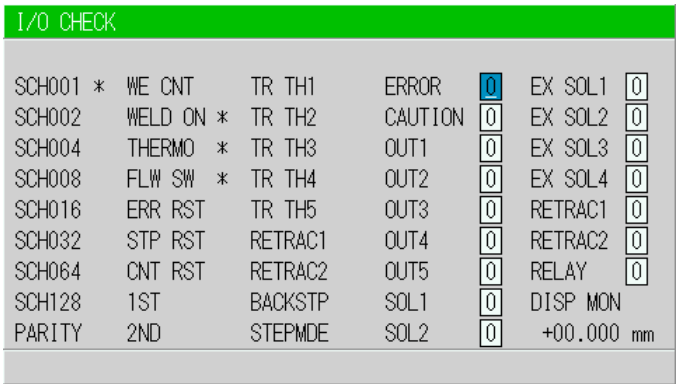
Set the lower limit of resistance value for pre-check.

f. PRECHECK MONITOR

Displays the monitor resistance value at the pre-check welding.

13. I/O CHECK Screen

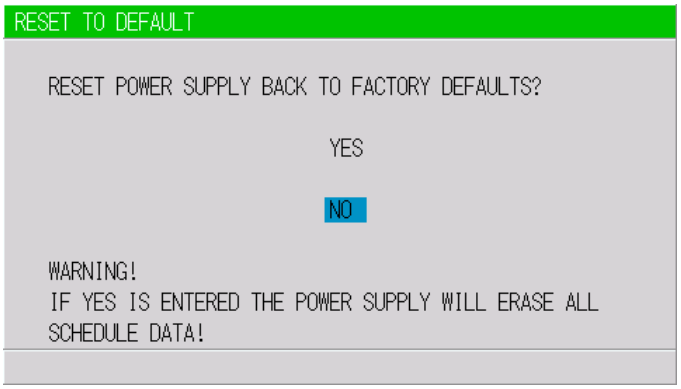
This screen is used to check the status of the external I/O signals. The "*" symbol appears when the corresponding input signal is ON. The asterisk disappears if the signal is OFF. Set the cursor reading to "0" to turn OFF the output signal, and "1" to turn it ON. Reception of an input signal while this screen is showing will not activate the corresponding function. You cannot move to another screen while the 1ST or 2NDSTAGE signal is input.



NOTE: Not all fields are present on **Basic** Models.

14. RESET TO DEFAULT Screen

This screen is used to initialize the Power Supply's memory (i.e., to restore the initial settings). Initialization will not clear the memory of the Pendant. To initialize, move the cursor over **YES** or **NO** and press the **ENTER** key.



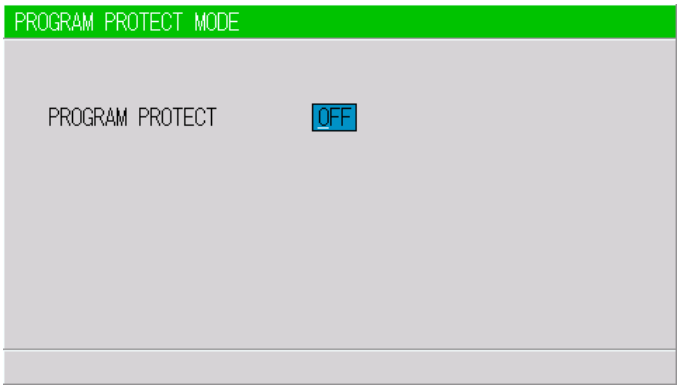
(a) YES	Initializes the Power Supply memory (restores the initial settings). After initialization, the screen will reflect the settings shown in this chapter.
(b) NO	Returns the display to the **MENU** screen without initializing the Power Supply memory.

15. PROGRAM PROTECT MODE Screen

When this function is used, set values cannot be changed by any person other than the supervisor. **PROGRAM PROTECT** is usually set to OFF. When it is set to ON, set values cannot be changed until **PROGRAM PROTECT** is set to OFF again.

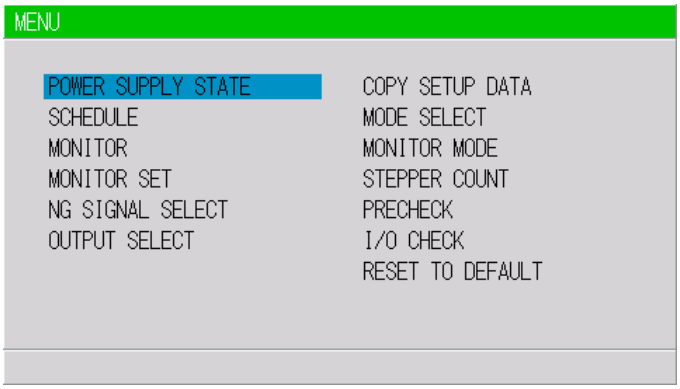
Follow the procedure below to change the setting of **PROGRAM PROTECT**.

1. Turn the power supply ON using the ▼ key pressed or connect the MA-660A to the circuit cable with the power supply turned ON. The following screen is displayed:

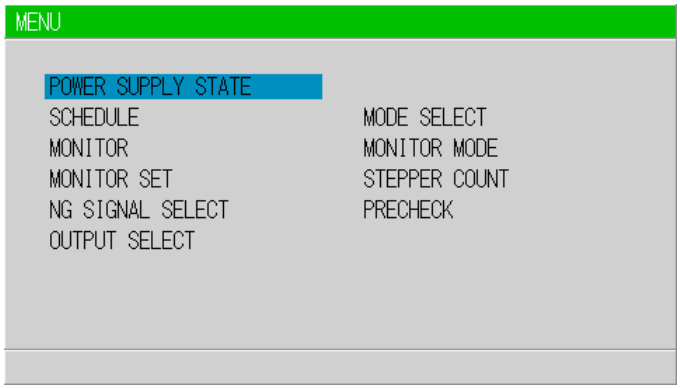


2. When the **ENTER** key is pressed after the **+ON** key is pressed, **ON** is displayed. You cannot go to other screens from this screen. Also, the external signals cannot be received.
3. Turn off the power supply and turn on it again, or disconnect the MA-660A with the power supply turned on and connect to the circuit cable again. When **PROGRAM PROTECT** is ON, the display of the **MENU** screen changes. **COPY SETUP DATA, I/O CHECK** and **RESET TO DEFAULT** are not displayed. On the other screens, the cursor can be moved and the settings can be checked, but the settings cannot be changed.

<When the PROGRAM PROTECT is OFF>



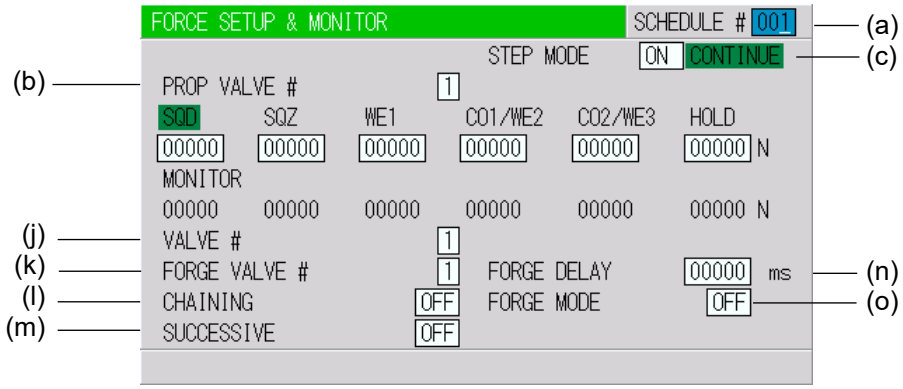
<When the PROGRAM PROTECT is ON>



Section III. Options Available On Advanced Models Only

16. FORCE SETUP & MONITOR Screen

This screen is used to set and monitor the force of the electro pneumatic proportional valve. Two electro pneumatic proportional valves can be used. The ANALOG OUT output terminal (voltage output proportional to force) for electro pneumatic proportional valve and the ANALOG IN input terminal (voltage input proportional to force) for force measurement have two channels, respectively. Also, chaining, successive and forge force functions can be set.



a. SCHEDULE

Select from #001 to #255 to set the **SCHEDULE**.
Normally select #001 first, then select additional schedules in sequential order.

b. PROP VALVE

Two electro pneumatic proportional valves can be connected.
Select an electro pneumatic proportional valve to use.

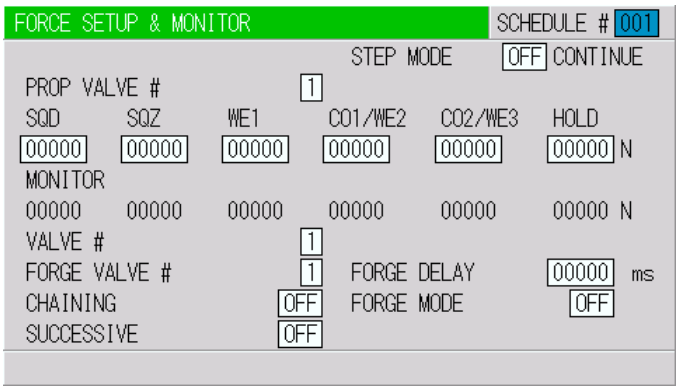
c. STEP MODE (CONTINUE)

This is the mode to check the force operation of the electro pneumatic proportional valve. In this mode, the force operation can be checked without flowing the welding current. The sequence proceeds to the next in order of SQD, SQZ, WE1, CO/WE2, CO2/WE3, and HOLD by pressing the ENTER key or input the STEP MODE signal. Do not move the cursor from STEP MODE during this mode. Settings cannot be changed. Valid only when FORCE CONTROL MODE on the PRESSURE REGULATOR screen is not 0.

Turning on the step operation mode. Set STEP MODE to ON.

SQD

Closes the 1ST signal. When the 1ST signal is input, the force set in SQD is output to the electro pneumatic proportional valve (ANALOG OUT), and SQD and CONTINUE blink. The measured value input in the force input (ANALOG IN) is displayed at the monitor of SQD.



SQZ

The sequence proceeds from SQD to SQZ by press the ENTER key or input STEP MODE signal. The force set in SQZ is output to the electro pneumatic proportional valve (ANALOG OUT), and SQZ and CONTINUE blink.

The measured value input in the force input (ANALOG IN) is displayed at the monitor of SQZ.

WE1

The sequence proceeds from SQZ to WE1 by pressing the ENTER key or input the STEP MODE signal. The force set in WE1 is output to the electro pneumatic proportional valve (ANALOG OUT), and WE1 and CONTINUE blink.

The measured value input in the force input (ANALOG IN) is displayed at the monitor of WE1.

CO1 / WE2

The sequence proceeds from WE1 to CO1/WE2 by pressing the ENTER key or input the STEP MODE signal. The force set in CO1/WE2 is output to the electro pneumatic proportional valve (ANALOG OUT), and CO1/WE2 and CONTINUE blink.

The measured value input in the force input (ANALOG IN) is displayed at the monitor of CO1/WE2.

CO2 / WE3

The sequence proceeds from CO1/WE2 to CO2/WE3 by pressing the ENTER key or input the STEP MODE signal. The force set in CO2/WE3 is output to the electro pneumatic proportional valve (ANALOG OUT), and CO2/WE3 and CONTINUE blink.

The measured value input in the force input (ANALOG IN) is displayed at the monitor of CO2/WE3.

HOLD

The sequence proceeds from CO2/WE3 to HOLD by pressing the ENTER key or input the STEP MODE signal. The force set in HOLD is output to the electro pneumatic proportional valve (ANALOG OUT), and HOLD and CONTINUE blink.

The measured value input in the force input (ANALOG IN) is displayed at the monitor of HOLD.

Turning off the step operation mode

The step operation mode ends by pressing the **ENTER** key or input the **STEP MODE** signal. Open the 1ST signal. The force output to the electro pneumatic proportional valve (ANALOG OUT) becomes the setting on the setting on the PRESSURE REGULATOR screen, and **HOLD** and **CONTINUE** stops blinking.

d. SQD

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during SQD.

e. SQZ

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during SQZ.

f. WE1

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during WE1.

g. CO1/WE2

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during CO1/WE2.

h. CO2/WE3

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during CO2/WE3.

i. HOLD

Set the force of the electro pneumatic proportional valve (ANALOG OUT) output during HOLD.

j. VALVE

Two or four valves (welding heads) can be connected to the Power Supply. Use this setting to select which of the two valves to use. Operation differs according to the VALVE MODE setting on the MODE SELECT screen.

When VALVE MODE is 1 VALVE
Set the valve # in the range of 1 to 4.
EX SOL1 to EX SOL4 on the I/O terminal block.
VALVE #1: EX SOL1 VALVE #3: EX SOL3
VALVE #2: EX SOL2 VALVE #4: EX SOL4

When VALVE MODE is 2 VALVE
Set the valve # in the range of 1 to 2.
SOL1 and SOL2, and EX SOL1 to EX SOL2 on the I/O terminal block are used for valve output.
VALVE #1: SOL1, SOL2
VALVE #2: EX SOL1, EX SOL2

k. FORGE VALVE

The forge force function can be used. The forge valve can be used at the given timing (the head force can be changed) except the valve selected in **VALVE #**. Select a valve to output the forge force. Operation differs according to the VALVE MODE setting on the MODE SELECT screen.

When VALVE MODE is 1 VALVE
The forge valve No. is set in the range of 1 to 4.
Do not set the same number as that used for the valve No.
EX SOL1 to EX SOL4 on the I/O terminal block are used for valve output.
FORGE VALVE #1: EX SOL1 FORGE VALVE #3: EX SOL3
FORGE VALVE #2: EX SOL2 FORGE VALVE #4: EX SOL4

When VALVE MODE is 2 VALVE
FORGE VALVE # is fixed to 4.
EX SOL4 on the I/O terminal block is used for valve output.

Valid only when FORGE MODE is ON.

l. CHAINING

Used for the chaining function. The welding is performed with SCHEDULEs with the chaining setting in order while the start signal (1ST and 2ND) is input.

All values of the chained schedules must be entered, especially the turns ratio, to ensure proper weld output.

For example, when CHAINING for SCHEDULE 1, 2, 5, and 6 are ON, the welding is performed sequentially in order of SCHEDULE 1 → SCHEDULE 2 → SCHEDULE 5 → SCHEDULE 6 by the start signal (1ST and 2ND) input.

m. SUCCESSIVE

Used for the successive function.
The welding is performed with SCHEDULEs with the successive setting in order each time the start signal (1ST and 2ND) is input.

For example, when SUCCESSIVE for SCHEDULE 1, 2, 5, and 6 are ON, the welding is performed singly in order of SCHEDULE 1 → SCHEDULE 2 → SCHEDULE 5 → SCHEDULE 6 each time the start signal (1ST and 2ND) is input.

The CHAINING setting has a priority to the SUCCESSIVE setting.

n. FORGE DELAY

The forge force function can be used. The forge valve can be used at the given timing (the head force can be changed) except the valve selected in **VALVE #**.
Set the timing to output the forge force. Operation differs according to the VALVE MODE setting on the MODE SELECT screen.

When VALVE MODE is 1 VALVE
The forge valve operates from the end of SQD through the forge delay time elapses.

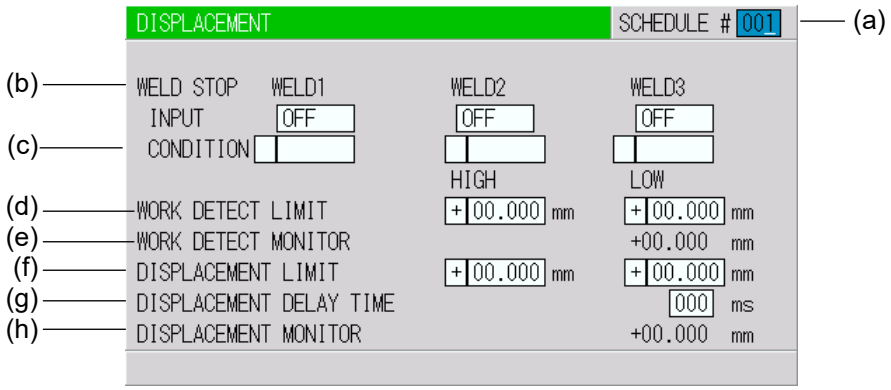
When VALVE MODE is 2 VALVE
The forge valve operates from the beginning of WE1 through the forge delay time elapses.
Valid only when FORGE MODE is set to ON.

o. FORGE MODE

The forge force function can be used. The forge valve can be used at the given timing (the head force can be changed) except the valve selected in **VALVE #**. Set whether or not to use the forge force.

17. DISPLACEMENT Screen

This screen is used to make a measurement using a displacement gauge and set the weld stop function.



a. SCHEDULE

Select from #001 to #255 to set the **SCHEDULE**.
Normally select #001 first, then select additional schedules in sequential order.

b. WELD STOP INPUT

Select items for weld stop.
OFF: External Input, **WE1** to **WE3**Stop Input are effective.
DISPLC: Weld Stop works at the set displacement value.
CURR: Weld Stop works at the set current value.
VOLT: Weld Stop works at the set voltage value.
POWER: Weld Stop works at the set power value.
PULSE: Weld Stop works at the set pulse width.

c. WELD STOP CONDITION

Set values for items selected in **WELD STOP INPUT**.
OFF: Not displayed.
DISPLC: Set the value of displacement.
CURR: Set current value.
VOLT: Set voltage value.
POWER: Set power value.
PULSE: Set pulse width.

d. WORK DETECT LIMIT
e. WORK DETECT MONITOR

The presence or absence of work piece can be detected by measuring the head travel distance from the beginning of SQD through the end of SQZ. The presence or absence and overlapping of work piece can be detected.

In **WORK DETECT LIMIT**, set the upper limit (HIGH) and the lower limit (LOW) in consideration of the difference between the head travel distance from the beginning of SQD through the end of SQZ and the presence or absence of a work piece to detect.

In **WORK DETECT MONITOR**, the measured value of the head travel distance from the beginning of SQD through the end of SQZ at welding is displayed.

In **WORK DETECT LIMIT**, you can set a value checking the measured value of work piece detection when the head is actually operated. To use the work piece detection function, the used displacement gauge should be ready at any time to measure the displacement from force releasing to force applying (the measurement range of the displacement gauge is larger than distance between electrodes at force releasing). Otherwise, the work piece detection will not be done properly.

f. DISPLACEMENT LIMIT
g. DISPLACEMENT DELAY TIME
h. DISPLACEMENT MONITOR

Measures the degree of work piece collapse by measuring the head travel distance from the pre-check start to the displacement delay time elapses.
The degree of collapse in fusing welding can be controlled.

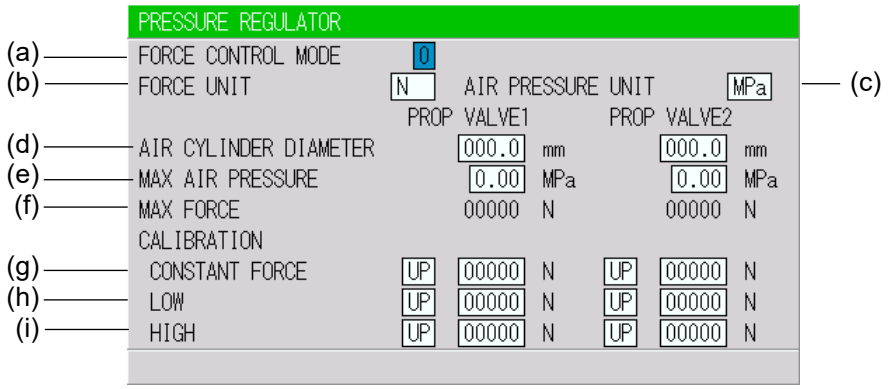
In **DISPLACEMENT LIMIT**, set the upper limit (HIGH) and the lower limit (LOW) to control the head travel distance (the degree of work piece collapse) from the pre-check start to the displacement delay time elapses.

In **DISPLACEMENT DELAY TIME**, set the delay time from the end of WE3 to the displacement measurement. Since the degree of work piece collapse changes by remaining heat of electrode even after welding, set the time in consideration of the timing to make a displacement measurement. Up to the time set in HOLD can be set.

In **DISPLACEMENT MONITOR**, the head travel distance (the degree of work piece collapse) from the pre-check start to the displacement delay time elapses is displayed.

18. PRESSURE REGULATOR Screen

This screen is used to set the units of force and air pressure, set the maximum force, and calibrate force.



a. FORCE CONTROL MODE

Sets the control mode of the electro pneumatic proportional valve.

0: Mode not using the electro pneumatic proportional valve. The electro pneumatic proportional valve (ANALOG OUT) is not output.

1: Mode using the electro pneumatic proportional valve. The electro pneumatic proportional valve (ANALOG OUT) is output.
- At the operation of welding sequence, SQD, SQZ, WE1, CO1/WE2, CO2/WE3, and HOLD settings are output to the electro pneumatic proportional valve (ANALOG OUT).
- After the completion of welding sequence, the CALIBRATION CONSTANT FORCE setting is output to the electro pneumatic proportional valve (ANALOG OUT).
- Set AIR CYLINDER DIAMETER and MAX AIR PRESSURE to set the maximum force. (CALIBRATION LOW and HIGH settings are not used.)
- Check the force before using this.

2: Mode using the electro pneumatic proportional valve. The electro pneumatic proportional valve (ANALOG OUT) is output.
- At the operation of welding sequence, SQD, SQZ, WE1, CO1/WE2, CO2/WE3, and HOLD settings are output to the electro pneumatic proportional valve (ANALOG OUT).
- After the completion of welding sequence, the HOLD setting is output to the electro pneumatic proportional valve (ANALOG OUT).
- Set AIR CYLINDER DIAMETER and MAX AIR PRESSURE to set the maximum force. (CALIBRATION LOW and HIGH settings are not used.)
- Check the force before using this.

3: Mode using the electro pneumatic proportional valve. The electro pneumatic proportional valve (ANALOG OUT) is output.
- Regardless of welding sequence operation, the CALIBRATION CONSTANT FORCE setting is output to the electro pneumatic proportional valve (ANALOG OUT).
- Set AIR CYLINDER DIAMETER and MAX AIR PRESSURE to set the maximum force. (CALIBRATION LOW and HIGH settings are not used.)

Check the force before using this.

4: Mode using the electro pneumatic proportional valve. The electro pneumatic proportional valve (ANALOG OUT) is output.
- At the operation of welding sequence, SQD, SQZ, WE1, CO1/WE2, CO2/WE3, and HOLD settings are output to the electro pneumatic proportional valve (ANALOG OUT).
- After the completion of welding sequence, the CALIBRATION CONSTANT FORCE setting is output to the electro pneumatic proportional valve (ANALOG OUT).
- Set CALIBRATION LOW and HIGH to set the maximum force. (AIR CYLINDER DIAMETER, MAX AIR PRESSURE and AIR PRESSURE UNIT settings are not used.) Check the force before using this.

b. FORCE UNIT

Select the unit of force among N, kgf and lbf.

c. AIR PRESSURE UNIT

Select the unit of pneumatic pressure among Mpa, bar and psi.

d. AIR CYLINDER DIAMATER

Used when FORCE CONTROL MODE is 1 to 3.
Set the diameter of pneumatic cylinder.

e. MAX AIR PRESSURE

Used when FORCE CONTROL MODE is 1 to 3.
Set the maximum pneumatic pressure supplied to the electro pneumatic proportional valve.

f. MAX FORCE

Displays the maximum force of the set electro pneumatic proportional valve.

g. CALIBRATION CONSTANT FORCE

Used when FORCE CONTROL MODE is 1, 3 or 4.

FORCE CONTROL MODE is 1 or 4:

Set the force output to the electro pneumatic proportional valve (ANALOG OUT) after the completion of welding sequence.

FORCE CONTROL MODE is 3:

Set the force output to the electro pneumatic proportional valve (ANALOG OUT) Regardless of welding sequence operation.

UP and DW at the left side of CALIBRATION CONSTANT FORCE can be used when FORCE CONTROL MODE is 3.

The force can be checked with this setting when FORCE CONTROL MODE is 3.

Set AIR CYLINDER DIAMETER and MAX AIR PRESSURE.

Set the force used to CALIBRATION CONSTANT FORCE.

The force is applied by changing UP on the left side of CALIBRATION CONSTANT FORCE into DW and released by returning the setting to UP.

The force setting and the force can be checked by measuring the force while the force is applied.

When there is difference between the set value and the measured value, adjust either AIR CYLINDER DIAMETER or MAX AIR PRESSURE so that the set value and the measured value become the same.

h. CALIBRATION LOW
i. CALIBRATION HIGH

Used when FORCE CONTROL MODE is 4.

Set CALIBRATION LOW and HIGH to set the maximum force.

UP and DW on the left side of CALIBRATION LOW and HIGH can be used when FORCE CONTROL MODE is 4.

The force can be checked with these settings when FORCE CONTROL MODE is 4.

The force is applied by changing UP on the left side of CALIBRATION LOW into DW and released by returning the setting to UP. About 30% of the maximum force is applied.

Measure the force while the force is applied, and input the measured value in CALIBRATION LOW.

The force is applied by changing UP on the left side of CALIBRATION HIGH into DW and released by returning the setting to UP. About 80% of the maximum force is applied.

Measure the force while the force is applied, and input the measured value in CALIBRATION HIGH.

CHAPTER 4
OPERATING INSTRUCTIONS

Section I: Introduction

Operator Safety

WARNING

- DEATH ON CONTACT may result if personnel fail to observe the safety precautions labeled on the equipment and noted in this manual. **HIGH VOLTAGE** is used in the operation of this equipment.
- To prevent blindness or eye injury, ***wear safety goggles at all times during welding***.
- ***Be careful of moving parts.*** You can be injured by moving parts during welding.
- Do ***not*** wear loose clothing or jewelry around moving parts. They could get caught and cause injury.

Before You Start

Before operating the Power Supply, you ***must*** be familiar with the following:

- The principles of resistance welding and the use of programmed weld schedules.
- The location and function of Controls and Indicators (see *Chapter 1*).
- How to select and use the Power Supply functions for your specific welding applications. For more information (see *Chapter 3*).
- Check that the display screen and lamps are turned on normally.

Preparing for Operation

Verify that the electrical and water supplies meet the electrical and cooling (water) requirements, as shown in *Appendix A, Technical Specifications*. The electrical and water supplies must also meet all applicable local, state, and federal safety standards.

Section II: Operation

CAUTION

If no secondary toroidal coil is connected, make sure that the Power Supply mode is set to **PRIMARY RMS** or **PRIMARY LIMIT** or you may damage the Power Supply.

Starting Welding Operation

1. Turn the cooling water supply ON at the temperature and flow rate shown in *Chapter 2*.
2. Turn the input power ON. Observe that the red **WELD POWER** lamp lights and green **READY** lamp blinks for 7 seconds, then goes off.
3. Press the **MENU** key on the Pendant to see the **MENU** screen.
4. Move the cursor to **SCHEDULE MODE** and press the **ENTER** key.
5. Set each item as described in *Chapter 3*.
6. Again press the **MENU** key to bring back the Menu screen.
7. Move the cursor to **SCHEDULE** and press the **ENTER** key.
8. Set each item as described in *Chapter* 3.

   NOTE: For initial set-up, current settings should be a little lower than predicted to prevent damage from excessive settings.
9. Re-set the schedule so that the work piece will be welded adequately.
10. When welding plural work pieces according to plural schedules, change **SCHEDULE #** and set new time and welding current.
11. Set the upper and lower limits on **MONITORSET** screen for each **SCHEDULE#.**

Check the Valve Sequence

1. Press and hold the Power Supply **WELD ON/OFF** switch until the green LED goes out.
2. Initiate a start signal while the **READY** lamp is ***not*** on, and check each sequential operation.

   WARNING: When confirming the operation, check that the Squeeze time (SQZ) is sufficient. If the welding current begins before the welding electrodes have reached sufficient force, expulsion is produced.

3. If no error is detected in Step 2, ensure that the three **READY** requirements are met:
   - The Power Supply **WELD ON/OFF LED** must be ON.
   - The **ON/OFF** setting of the Pendant must be set to ON.
   - An external **WELD ON/OFF** signal must be present at the I/O terminal block.
4. Check that the Power Supply green **READY** lamp is lit
5. Start the weld sequence and confirm that the welding current is flowing normally by checking the red **WELD** lamp and the Monitor screen.
6. Make any necessary adjustments to the schedule so that the work piece will be properly welded.
7. When welding multiple work pieces according to multiple schedules, change the **SCHEDULE #** and set new time and welding current.
8. Set the upper and lower limits on the Pendant **MONITOR SET** screen for each **SCHEDULE #.**
9. Begin welding following normal procedures. Adjust the **SCHEDULE** settings as necessary.

Section III: Shutdown

Turning the Power Supply OFF

Rotate breaker handle to the OFF position. If servicing of power module inside the enclosure is required, wait 20 minutes to avoid electric shock.

CHAPTER 5
MAINTENANCE
Section I: Troubleshooting

The table below lists the **ERROR** messages that may be displayed on the Pendant and what those messages mean, and corrective actions you can take.

FAULT CODE	CONTENTS	CAUSE	MEASURES
E-01	SYSTEM ERROR	An Error has been detected in the **IS-800CA/1400CA**.	Re-cycle the power. If E-01 SYSTEM ERROR is displayed again, repair is required. Contact AMADA WELD TECH.
E-02	MEMORY ERROR	The welding schedule data is different than the programmed schedule.	Check all settings. If the data in the memory is corrupt, the possible causes are: Abnormal Power Supply voltage from power surge or electrostatic discharge Flash memory's rewrite limit has been exceeded If the error occurs again after initialization, the Power Supply will need repair. Contact AMADA WELD TECH.
E-03	MEMORY TROUBLE		
E-04	PARITY ERROR	Input "Start" signal cable is open/broken, and a parity check error is detected.	Check the start signal input cable.
E-05	TRIP OF EXTERNAL THERMO	Welding transformer temperature rises and opens the external thermostat input circuit.	Low transformer temperature. When using a water-cooled transformer, properly adjust the temperature and flow rate of the cooling water.
		External signal input power is not connected.	Check the external input signal for proper connection.
E-06	TRIP OF INTERNAL THERMO	High equipment temperature causing the power transistor thermostat to open.	Ensure that the duty cycle does not exceed the specified value.
E-07	NO CURRENT	Squeeze of welding electrode is not sufficient.	Adjust the squeeze of the welding electrode.
		SQD or **SQZ** time is too short.	Check the setting of the **SQD** or **SQZ** time to determine whether it is too short. (Note: Set the **SQD** or **SQZ** time to a period longer than the stroke time of the electrode)
		NO CURRENT LEVEL is high.	Set a lower **NO CURRENT LEVEL**.
		Fuse inside the equipment is blown.	The fuse needs replacement. Contact AMADA WELD TECH
		Toroidal coil is not connected.	Connect the toroidal coil.
E-08	OUT LIMIT OF CURRENT ERROR	Welding current is out of **CURRENT** setting range on the **MONITOR SET** screen.	Check for stained welding electrode or loose cable connection.

FAULT CODE	CONTENTS	CAUSE	MEASURES
E-09	OUT LIMIT OF PULSE WIDTH ERROR	Welding Current pulse width is out of **PULSE HI** setting range on **MONITOR SET** screen.	Check that the transformer capacity is sufficient. Check workpiece and welding electrode.
E-10	SET ERROR	Primary current of turns ratio is out of range of the following formula: $\mathbf{X} \leq \left(\frac{\textbf{HEAT setting}}{\textbf{TURNS RATIO}} \right) \leq \mathbf{Y}$ **IS-800CA**: X = 15, Y = 800 **IS-1400CA**: X = 30, Y = 1400	Correct each setting.
		The **WELD1**, **WELD2**, and **WELD3** values are all "0."	
		The total time of **UP SLOPE** and **DOWN SLOPE** is longer than the **WELD** time.	
		HEAT setting, including **RATIO** setting is equal to or lower than UF or DL setting.	
		Although STEPPER MODE is set to LINER or FIXED, STEPPER COUNT of STEP number set for START ON STEP # are all "0."	
		The series of welding currents in WELDs without COOL are different than the consecutive UP/DOWN settings.	
		UP/DOWN is set in the consecutive portion of a series of WELDs without COOL and the portion meets specific conditions.	
		On **Advanced** Power Supply models the transformer weld frequency was set greater than 1000Hz	
E-11	SET OVER	**HEAT** setting (including **RATIO** setting) is equal to or lower than UF or DL setting.	Correct each setting.
		HEAT setting (including **RATIO** setting) is larger than the maximum current, voltage, or power setting.	
		HEAT setting (including **RATIO** setting) is lower than the minimum value of current, voltage, or power setting.	
E-12	STOP	External STOP input circuit is open.	Rectify cause of the STOP, and then close the STOP circuit.
		Power supply for external input is not connected.	Check the external input signal for proper connection.

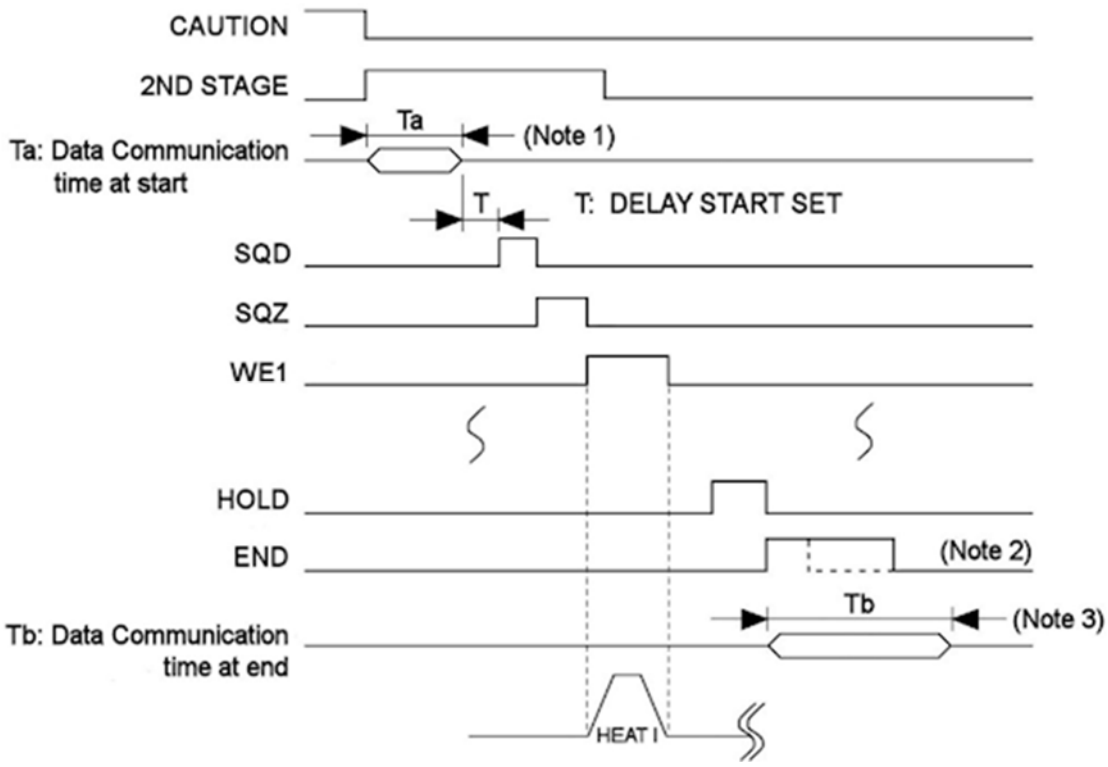
FAULT CODE	CONTENTS	CAUSE	MEASURES
E-13	OVER CURRENT	Primary current above the limit is detected.	Check for welding transformer and welding electrode problems. Check that the toroidal coil or the voltage detection cable is connected in the secondary control.
E-14	SHORT WITH GROUND	The output cable between the welding transformer and the power supply is grounded.	Check the output cable.
E-15	LACK OF COOLING WATER	Cooling water flow is low.	Increase the cooling water flow rate to meet specifications.
		Power supply for external input is not connected.	Check external input signal for proper connection.
E-16	START ERROR	Schedule signal has not been entered when the external start signal is present.	Input the schedule before the start signal.
E-17	AC 50/60 FREQUENCY FAILURE	Frequency of incoming power supply is not stable, and equipment cannot determine whether it is at 50 Hz or 60 Hz.	Check power source.
E-18	OUT LIMIT OF VOLTAGE ERROR	Secondary voltage is out of the **VOLT** setting range on the **MONITOR SET** screen.	Check for stained welding electrodes and low electrode force.
E-19	OUT LIMIT OF POWER ERROR	Welding power is out of the **POWER** setting range on the **MONITOR SET** screen.	
E-20	INTERRUPT ERROR	The current shutoff signal is present before the start signal.	Check interrupt input signal.
E-21	NO VOLTAGE	No detection of voltage across welding electrodes.	Make sure that the cable detecting the voltage across welding electrodes is connected.
		NO VOLTAGE LEVEL is too high.	Set a lower **NO VOLTAGE LEVEL**.
E-22	OVER CURRENT (DC 24 V)	Built-in 24 VDC power supply on the rear panel is shorted and overloaded.	Turn off the power and check the I/O connection on the rear panel.
E-23	SHORT CIRCUIT	The output cable is shorted.	Check the output cable.
E-24	PRECHECK ERROR	Current is outside of the upper / lower limit setting on the **PRECHECK** screen (when the PRECHECK Current Supply is used).	Check for contamination on the weld pickup electrodes, electrodes and workpieces. Check range set on the PRECHECK Screen.
E-25	RAM MEMORY ERROR	Count data or schedule number data stored in memory is corrupt.	Memory was erased because the period for retaining memory of the count data elapsed over the specified period. Count data memory is retained up to 10 days after the power supply is turned off.
E-26	LACK OF WELD COUNT	The counted number of welds is less than the **WELD COUNT** setting.	Add more welds to equal the **WELD COUNT** setting.

FAULT CODE	CONTENTS	CAUSE	MEASURES
E-27	END OF STEP	The **STEPPER COUNT** has completed its final step.	Dress or replace the tip, then reset the step.
E-28	COUNT UP	The total weld count is equal to the preset count value.	Reset the counter.
E-29	PHASE MISSING	A welding power supply error is present.	Confirm that the welding power supply is connected correctly.
E-30	POWER FAILURE	The power was out during welding.	Check for the cause of the instantaneous power failure.
E-31	OUT LIMIT OF TIME ERROR	Weld time is out of the **TIME** setting range on the **MONITOR SET** screen.	Check the welding stop input of the external interface.
E-32	COMM SETTING ERROR	The bi-directional data write (in external communications), is either out of the range or the data format is wrong.	Check the write data.
E-33	SUCCESSIVE BACK STEP ERROR	The first SCHEDULE is selected. SCHEDULE cannot be returned any more.	Check the back step input. Check that SCHEDULE is returned to the first one.
E-34	TIP DRESS REQUIRED	Counting has arrived at the tip dress setting value. This occurs when the tip dress is set for stepper.	Dress the tip, then reset it.
E-35	APPROACHING CAP CHANGE	Capacitor change count is approaching the change setting value.	The time for a capacitor change is approaching. Check and reset it.
E-36	CAP CHANGE REQUIRED	STEPPER COUNT has completed its final step.	Dress or replace the tip, then reset step.
E-37	OUT LIMIT OF DISPLACEMENT ERROR	IS-800CA/1400CA **Advanced** ONLY: The displacement is out of the DISPLACEMENT LIMIT setting range on the DISPLACEMENT screen.	Check work pieces, welder and welding power supply voltage. Check range set at DISPLACEMENT LIMIT.
E-38	WORK DETECTERROR	IS-800CA/1400CA **Advanced** ONLY: The workpiece detection is out of the WORK DETECT LIMIT setting range on the DISPLACEMENT screen.	Check work piece setting and positioning. Check range set at WORK DETECT LIMIT.
E-39	WITHOUT EXTENSION BOARD	IS-800CA/1400CA **Advanced** ONLY: The optional extension board is not connected.	Recycle power. If the E-39 error WITHOUT EXTENSION BOARD is displayed again, repair is required. Contact AMADA WELD TECH

When the Welding Does not Start, Even if the Start Signal is present

When welding does not start even if the Start signal **2ND STAGE** signal is present, the following causes may be occurring:

- The Welder is not ready as indicated by the READY light.
- Start signal is shorter than DELAY START SET time setting.
- Start signal is input while the END signal is output.
- Start signal is input during communicating with the Pendant.



NOTES:

- When the next start signal is received while the monitor error is displayed on the Pendant, the **CAUTION** signal is turned OFF and the previous screen is displayed. At this time, the data is transferred to the Pendant from the Power Supply. The start signal is not received while the data is transferred. (Ta: 40 ms max. in the figure above.) When the monitor error is displayed, input the start signal more than (Ta) time.
- When the sequence ends, the **END** signal is output after **HOLD**. To make the cycle time faster, lower the output time of END signal. (Can be set in 10 ms increment. The minimum value is 10 ms.)
- When the **MONITOR** screen is displayed, the monitor data is transferred to the Pendant simultaneously with the **END** signal output (transmission time Tb1). The monitor data is not transferred when the screen other than **MONITOR** screen is displayed.

  The next Start signal is not received while the monitor data is transferred. Also, on every screen, the data is transferred to the Pendant from the Power Supply to display the monitor error when the monitor data is beyond/below the upper/lower limit (data communication time Tb2). The data communication time at end "Tb" is shown in the table below.

	MONITOR ERROR OCCURS	**MONITOR ERROR DOES NOT OCCUR**
MONITOR screen	Tb1: 164 ms max.	Tb1+Tb2+α: 280 (438) ms max.
Screens other than MONITOR screen	0 ms	Tb2: 113 (144) ms max.

* Time in ( ) is the time with RS-232C communication.

- When the RS-232C external communication function is set to the single-directional communication mode (**MODE SELECT** Screen), the monitor data is transferred to the host computer after the completion of welding (transmission time **Tc1**).

  Also, when the monitored value is outside the upper/lower limit on the **MONITOR SET** screen, the monitor error code is transferred to the host computer (transmission time **Tc2**). The Start signal is not received while during transmitting.

  To make start time faster, set the external communication function to OFF. Shown below is the data transmission time **Tc1** and **Tc2** when the communication speed is 9,600 bps. When the communication speed is 19,200 bps or 38,400 bps, the transmission time will be short.
- Data transmission time when the communication speed is 9,600 bps

Tc1	132 ms maximum
Tc2	42 ms maximum

Section II. Before You Start

IS-800CA / IS-1400CA Cleaning

CAUTION

When cleaning the exterior of the Power Supply, do ***not*** use paint thinner, benzene, or acetone. These chemicals can damage the surface finish on the Power Supply. Use a dry cloth or, if it is heavily soiled, use a cloth moistened with a mild detergent or alcohol.

IS-800CA / IS-1400CA Safety Precautions

DANGER

DEATH ON CONTACT may result if you fail to observe all safety precautions. ***Lethal voltages*** are present in the Power Supply. Perform the following steps to eliminate electrical shock hazard. Make sure external power is turned OFF before performing any maintenance procedures.

1. Turn the power to the Power Supply OFF.
2. Open the front door by turning the two quarter-turn screws.
3. Turn circuit breaker to OFF.

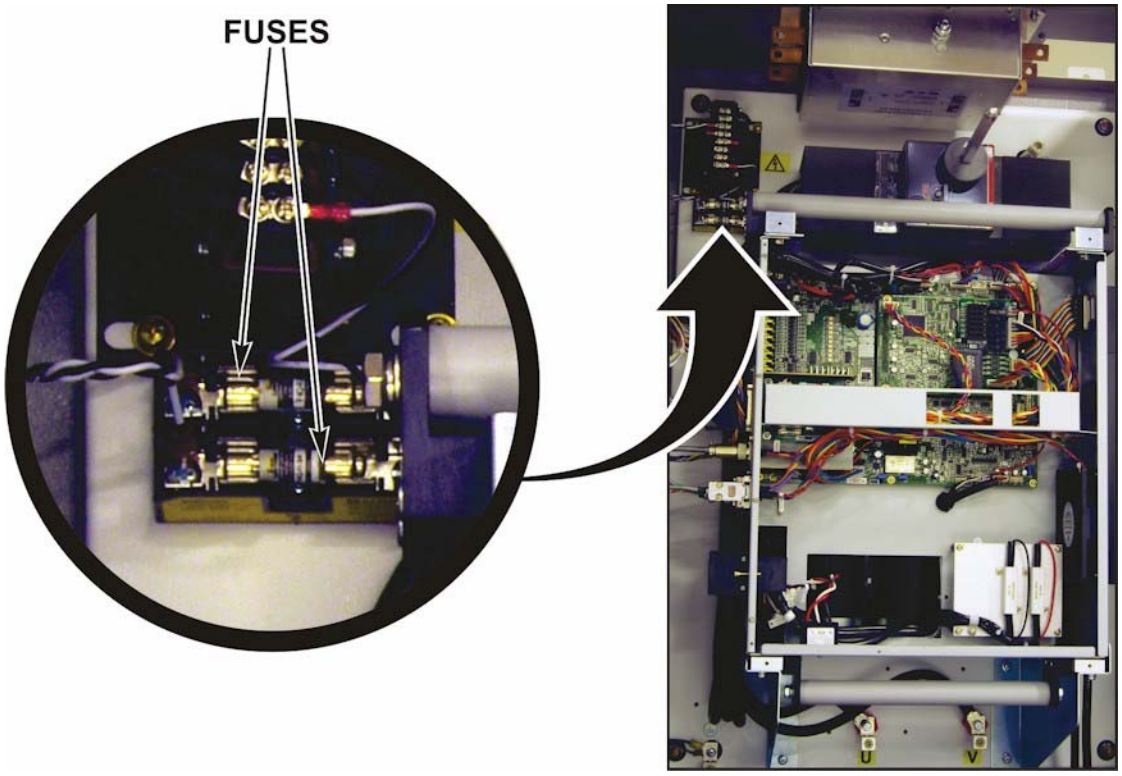
Section III: Fuse Failure and Replacement

CAUTION

Do ***not*** attempt to replace any fuses other than those described below. All other fuses in the Power Supply should ***only*** be serviced by factory-authorized technicians or serious damage to the Power Supply could result.

Power Supply

The Power Supply contains fuses located on the top left of the cabinet as shown below. Before replacing either fuse, determine what caused it to fail and make appropriate repairs.



FUSE	DESCRIPTION	150 VA valve transformer	250 VA valve transformer
2	Power Supply Transformer Fuse	P/N 330-175 0.75 amps, slow-blow	P/N 330-120 1.50 amps, slow-blow

Section IV: Maintenance Procedures

Cooling Maintenance

Perform the following maintenance on the cooling system:

- **Monthly** – Check the water hoses to assure there is no leakage.
- **Any time there is a chance that the water might freeze –** Drain the water.
- **Any time you believe that there is a build-up of sediment that might decrease the water flow and cause the Power Supply to overheat –** Drain and flush the hoses and heat sink/IGBT cooling chamber.

Checking Water Hoses

1. Disconnect power to the Power Supply then wait for 20 minutes after the power is removed before maintenance.
2. Check the input/output hoses on the right side of the Power Module and the interconnecting hoses on the left side for any sign of water leakage.
3. Turn off the water supply and squeeze the hoses to check for brittleness. Restore water flow.
4. Re-install the plastic high voltage protective cover with the four screws that secure it.
5. Close the Power Supply door and secure it with the two quarter-turn screws.
6. Reconnect power to the Power Supply, then set the circuit breaker to ON.

Draining Water Hoses

1. Turn off and tag the Power Supply circuit breaker, so the Power Supply cannot be operated while the water is drained.
2. Turn off the water source, wherever convenient.

   NOTE: Be sure to have a bucket or other receptacle handy to collect the drained water.
3. Disconnect both hoses at the bottom of the Power Supply and allow the water to drain into the bucket.
4. Allow the input and output hoses to drain into the bucket.
5. Leave the hoses disconnected until danger from freezing has passed.

Flushing Water Hoses and Cooling Chambers

1. Turn off and tag the Power Supply circuit breaker, so the Power Supply cannot be operated during flushing.
2. Turn off the water source, wherever convenient.

   NOTE: Be sure to have a bucket or other receptacle handy to collect the drained water.
3. Disconnect one of the hoses at the bottom of the Power Supply and allow the water to drain into the bucket.

4. Turn the water back on slightly, but enough to flush the system. When the water is running clean, turn the water OFF.
5. Reconnect the hose back onto the Power Supply and restore power and water.
6. Close the Power Supply door and secure it with the two quarter-turn screws.

   NOTE: To reduce damage to the Power Supply, should there be an external problem, reconnect external power to the Power Supply before turning the circuit breaker ON.
7. Turn the circuit breaker ON.

Section V: Power Module Replacement

Remove the Power Module

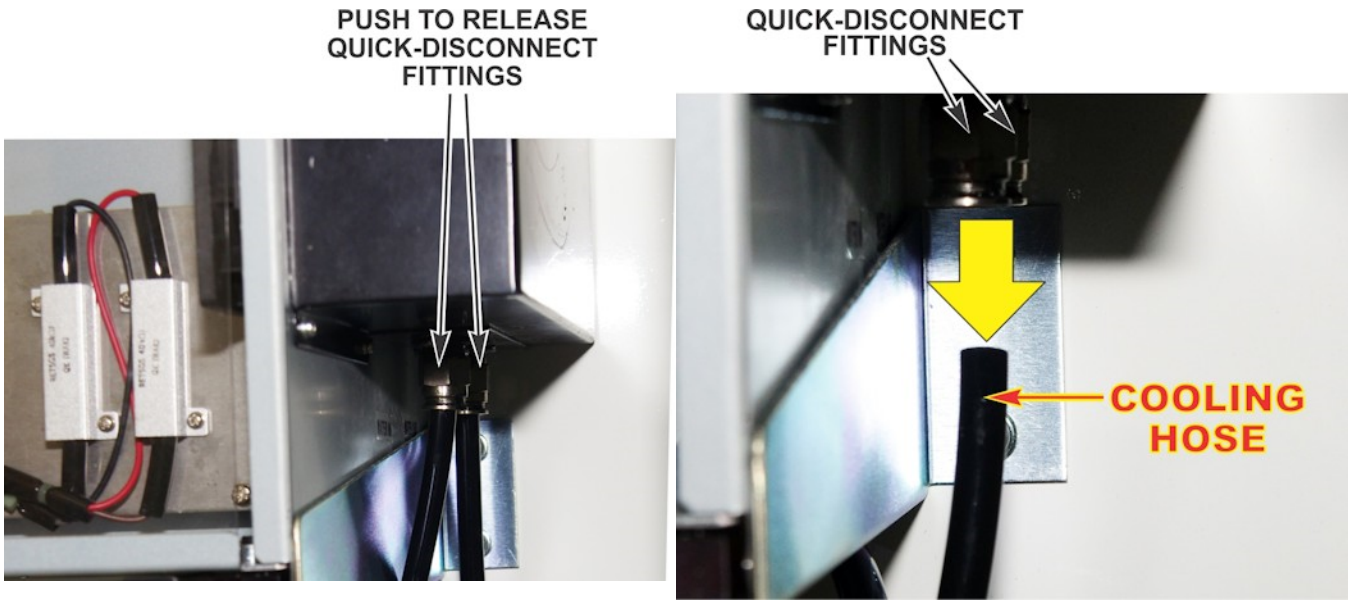
The Power Module is a one-piece assembly that can quickly and easily be removed, serviced, and replaced. ***Before you start***, disconnect power to the Power Supply, then wait for 20 minutes after the power is removed before removing the Power Module.

Cooling Water Hoses

1. Turn the water source OFF.

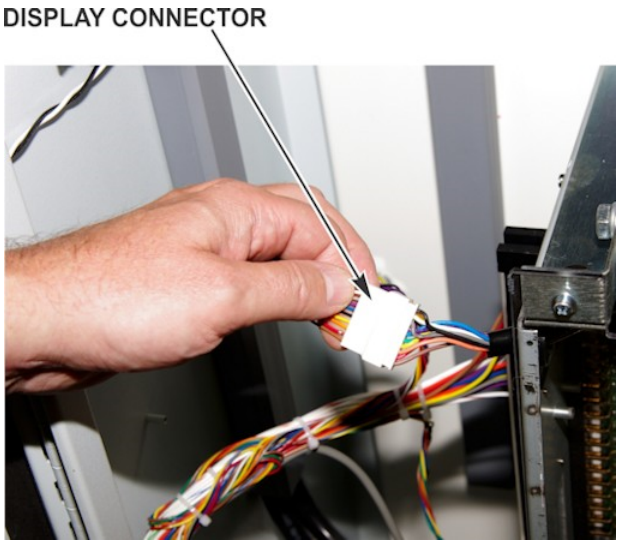
   NOTE: Place a bucket or other receptacle under the quick-disconnect fittings to collect any residual drained water.

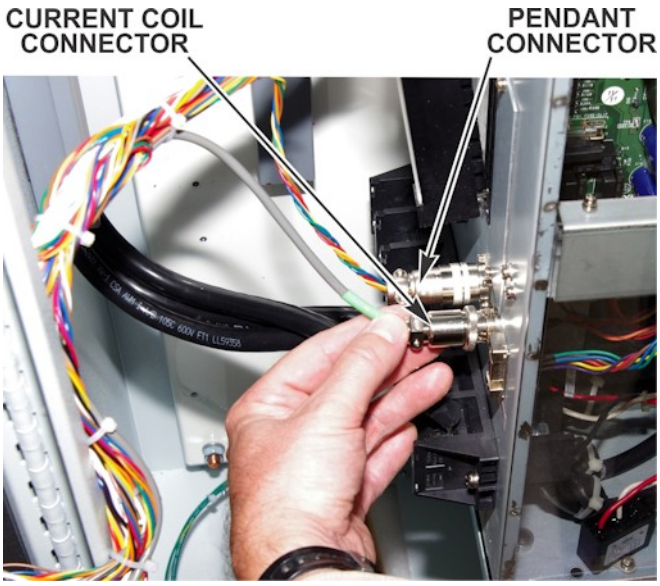
2. Push the quick-disconnect fittings at the bottom of the Power Module to disconnect both hoses and allow the water to drain into the bucket.

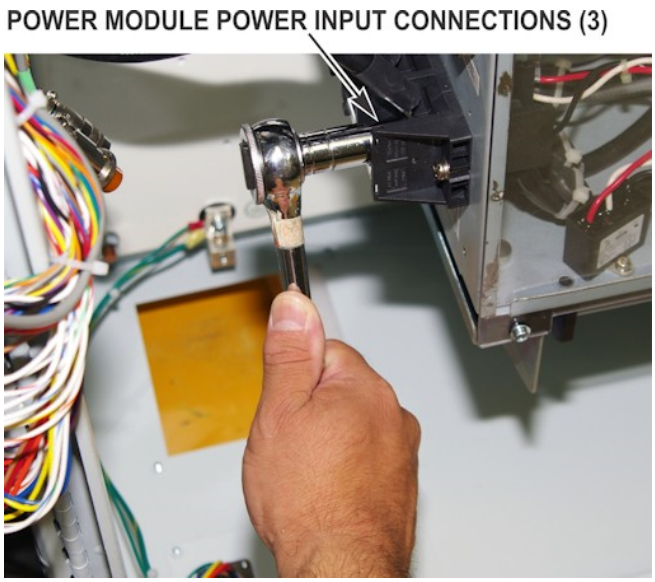


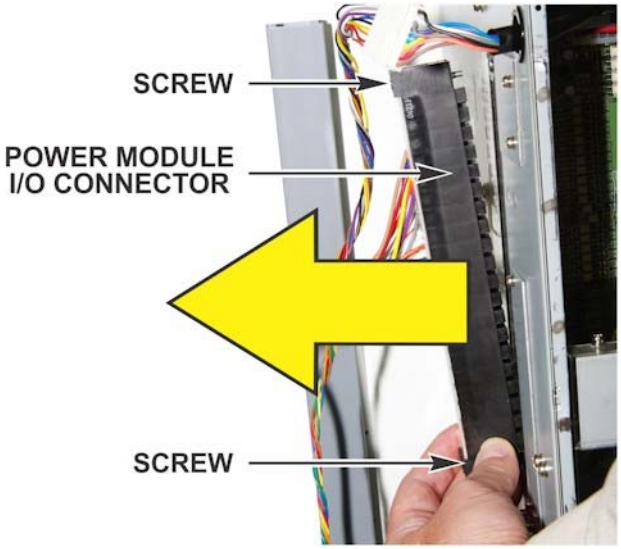
Disconnect the Wire Harness from the Main Board Connectors

Disconnect wire harness connectors from the Power Supply as shown below.









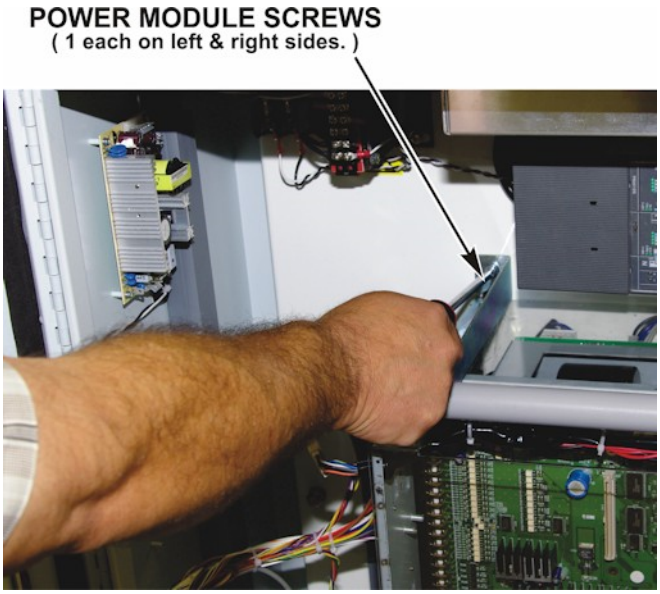
On the IS-800CA/1400CA Advanced power module also remove the 25-pin D-sub connector and displacement sensor connector (not shown)

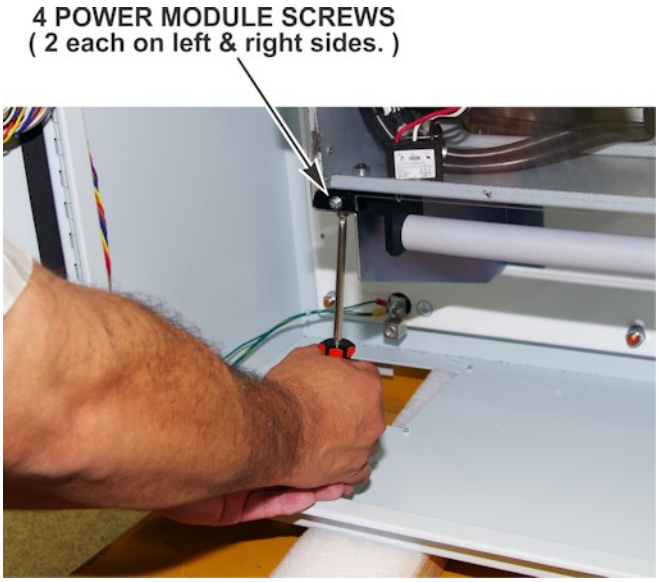
Remove the Power Module

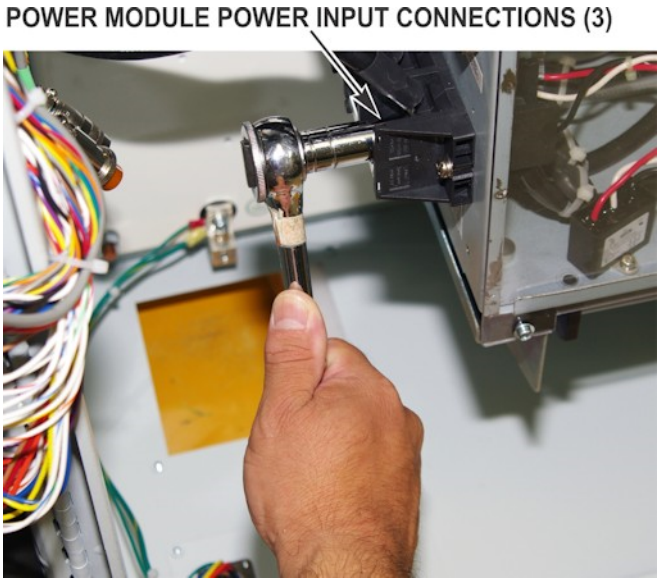
CAUTION

Before attempting to remove the Power Module, verify that ***all*** electrical connectors have been disconnected and are positioned so they will ***not*** be snagged during removal or you may damage the equipment.

NOTE: The weight of the Power Module is supported by the two support rails shown below. Remove the screws shown below in order to remove the Power Module from the cabinet.







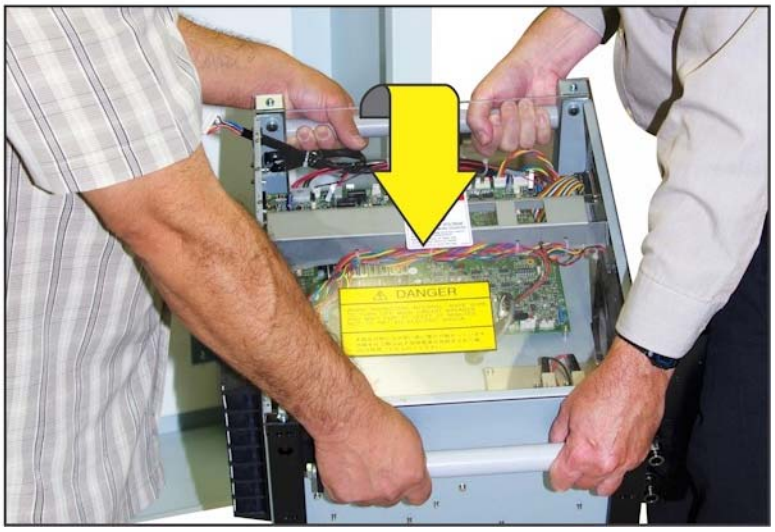
POWER MODULE HANDLE

POWER MODULE HANDLE

CAUTION: 2-PERSON LIFT

When all screws are removed, use at least one hand to hold the **POWER MODULE** on the support rails until you are ready to remove it to avoid dropping or damaging the unit.

When you are ready to remove the unit, use a 2-person lift as shown below.



Replace the Power Module

1. Replace or re-install the Power Module by carefully sliding it back onto the support rails.
2. While holding the Power Module in place with one hand, re-attach the screws securing the Power Module to the cabinet.
3. Re-install ***all*** connectors to the Power Module. Make sure the appropriate connectors on the wire harness are plugged into terminal strip TB1 on the door.
4. If necessary, re-install the cable bundles into the cable ties and secure them in place.
5. Reconnect the cooling water lines to the fittings on the bottom of the box. Use a 17 mm open end wrench to tighten the two compression nuts
6. Restore water flow.
7. Close the Power Supply door and secure it with the two latching screw-fasteners.
8. Reconnect power to the Power Supply, then set the circuit breaker ON.

Section VI: Repair Service, Storage, Shipment

Repair Service

If you have problems with your Control that you cannot resolve, please contact our service department at the address, phone number, or e-mail address indicated in the Foreword of this manual.

Preparation for Storage or Shipment

1. Disconnect power to the Power Supply then wait 20 after power is removed before the following procedures.
2. Turn off water source and disconnect the water hoses to the Power Supply. Using shop air, dry out the hoses.
3. Remove the circuit breaker line terminal cover and disconnect all line wires. Replace cover.
4. Disconnect all load wires.
5. Disconnect all signal wires
6. Remove any conduits from the top and bottom of the Power Supply as necessary.
7. If a secondary current sensor is used, disconnect the signal cable from the connector on the bottom of the Power Supply.
8. Replace the plastic cover and secure it with the four mounting screws.
9. Remove the Power Supply from its mounting location.
10. Repack the Power Supply into the original packing materials and packing box in which you originally received the Power Supply.

APPENDIX A
TECHNICAL SPECIFICATIONS

Specifications

Model No.		IS-800CA	IS-1400CA
Dimensions: inches **(W x H x D)** (mm) *(see isometric images on page 2-1)*		30.4" x 39.0" x 13.0" (772 mm x 991 mm x 330 mm)	31.0" x 52.0" x 13.0" (796 mm x 1,321 mm x 330 mm)
Weight		250 lb. (109 kg)	340 lb. (160 kg)
Max. input voltage (voltage level is factory set and is not field selectable)		3-phase, 380 – 480 VAC ±10% (50/60 Hz)	3-phase, 380 – 480 VAC ±10% (50/60 Hz)
Max. output current		800 A (peak value)	1,400 A (peak value)
Average max. duty cycle	Output current [( ) indicates duty cycle.] (at 40 °C, 1 kHz of welding frequency)	800 A (3%) 500 A (10.5%) 350 A (20%) 100 A (100%)	1400 A (3%) 1000 A (7%) 500 A (26%) 100 A (100%)
Number of schedules		255	
Control method *		Primary constant-current effective value control Secondary constant-current effective value control Secondary constant-power effective value control Primary constant-current peak value control Secondary constant-voltage effective value control Constant-phase control	
Transformer turns ratio * (TURN RATIO)		1.0 – 199.9	
Transformer frequency * (WELD TRANS FREQ)		600 – 3000 Hz (in units of 100 Hz) **Basic** unit 600 – 1000 Hz (in units of 100 Hz) **Advanced** unit	
Timer setting range *	SQD / squeeze delay time SQZ / squeeze time U1 / upslope 1 time WE1 / weld 1 time D1 / downslope 1 time COOL1 / cooling 1 time U2 / upslope 2 time WE2 / weld 2 time D2 / downslope 2 time COOL2 / cooling 2 time U3 / upslope 3 time WE3 / weld 3 time D3 / downslope 3 time HOLD / hold time OFF / off time (Note 1)	0000 – 9999 (ms) / 0000 – 9999 (CYC) 0000 – 9999 (ms) / 0000 – 9999 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 0000 – 9999 (ms) / 0000 – 0999 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 0000 – 9999 (ms) / 0000 – 0999 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 000 – 999 (ms) / 00 – 50 (CYC) 00000 – 20000 (ms) / 00000 – 00999 (CYC) 0 or 0010 – 9990 (ms) / 0000 – 0099 (CYC)	

<table>
<tr><th colspan="3">Model No.</th><th>IS-800CA</th><th>IS-1400CA</th></tr>
<tr><td colspan="3">Pulsation setting * (PULSATION)</td><td colspan="2">01 – 19 (settable for WELD1 to WELD 3, respectively)</td></tr>
<tr><td colspan="3">Valve setting * (VALVE)</td><td colspan="2">2 valves (VALVEx (SOLx), 1 and 2 Basic unit
8 valves (VALVEx (SOLx), 1 and 2; EX VALVEx (EX SOLx), 1 thru 4; RET VALVEx (RET SOLx); VALVE RELAY (SOL RELAY) Advanced unit</td></tr>
<tr><td colspan="3">Control gain * (GAIN)</td><td colspan="2">1 – 9</td></tr>
<tr><td colspan="3">Current monitor *
(CURRENT H/L)</td><td colspan="2">00.0 – 99.9 kA
0.00 – 9.99 kA</td></tr>
<tr><td colspan="3">Power monitor *
(POWER H/L)</td><td colspan="2">000.0 – 999.9 kW
00.00 – 99.99 kW</td></tr>
<tr><td colspan="3">Voltage monitor *
(VOLT H/L)</td><td colspan="2">0.00 – 9.99 V</td></tr>
<tr><td colspan="3">Pulse width monitor *
(PULSE H)</td><td colspan="2">010.0 – 100.0%</td></tr>
<tr><td colspan="3">Step-up/-down
(STEPPER COUNT)</td><td colspan="2">STEP
Up (down) ratio (RATIO)
Counter setting (COUNT)
} Selectable for each valve</td></tr>
<tr><td colspan="3">Weld count monitor
(PRESET COUNT)</td><td colspan="2">0000 – 9999</td></tr>
<tr><td rowspan="11">Setting range*
(HEAT)</td><td rowspan="5">Constant current control (Note 2)</td><td>80 kA range</td><td>---</td><td>04.0 – 80.0 kA</td></tr>
<tr><td>40 kA range</td><td>02.0 – 40.0 kA</td><td>02.0 – 40.0 kA</td></tr>
<tr><td>20 kA range</td><td>01.0 – 20.0 kA</td><td>01.0 – 20.0 kA</td></tr>
<tr><td>10 kA range</td><td>0.50 – 9.99 kA</td><td>0.50 – 9.99 kA</td></tr>
<tr><td>5 kA range</td><td>0.05 – 5.00 kA</td><td>0.05 – 5.00 kA</td></tr>
<tr><td rowspan="5">Constant power control</td><td>80 kA range</td><td>---</td><td>04.0 – 120.0 kW</td></tr>
<tr><td>40 kA range</td><td>02.0 – 60.0 kW</td><td>02.0 – 60.0 kW</td></tr>
<tr><td>20 kA range</td><td>01.0 – 20.0 kW</td><td>01.0 – 20.0 kW</td></tr>
<tr><td>10 kA range</td><td>0.50 – 9.99 kW</td><td>0.50 – 9.99 kW</td></tr>
<tr><td>5 kA range</td><td>0.05 – 5.00 kW</td><td>0.05 – 5.00 kW</td></tr>
<tr><td colspan="2">Constant voltage control</td><td colspan="2">0.20 – 9.99 V</td></tr>
<tr><td colspan="2">Constant phase control</td><td colspan="2">10.0 – 99.9%</td></tr>
<tr><td colspan="3">Cooling method</td><td colspan="2">Water cooled for IGBT’s and power components.
• Flow Rate: 6 liters/minute minimum.
• Water Temperature: 35°C maximum.
• Water Pressure: 40 psi maximum.
• Maximum ambient humidity ≤ 85% (non-condensing)</td></tr>
</table>

Model No.		IS-800CA	IS-1400CA
State indicator LED		[WELD POWER] lamp [READY] lamp [START] lamp [WELD] lamp [TROUBLE] lamp [WELD ON/OFF] lamp	
Operating environment	Ambient temperature Humidity Altitude Pollution degree	+5 to °C +40 °C 90% max. (no condensation) 1000 m max. 3	
Transport and storage conditions	Ambient temperature Humidity	-10 to +55 °C 90% max. (no condensation)	
Heat-resistant class		E	
Case protection		IP20	
Protective functions	Over current	200 A Fuse	200 A Fuse (per leg)
	No-current	Power is turned off in the following cases: a. When a secondary current is not detected in Secondary constant-current effective value control, Secondary constant-power effective value control, or Constant-phase control. b. When a primary	
	No-voltage	Under Secondary constant-voltage effective value control or Secondary constant-power effective value control, the supply of current is stopped when a secondary voltage cannot be detected.	
	Temperature	Overheating of power unit of inverter and welding transformer are detected.	
	Self-diagnostic error	Setting dates (e.g., schedule settings) are diagnosed.	
Setting accuracy (Note 3)		Within ± 3% of full scale	
Repetition accuracy (Note 3)		Within 4% of full scale	
FORCE Monitor Accuracy		Within 2% of full scale	
Accessory		Operation manual: 1 copy	

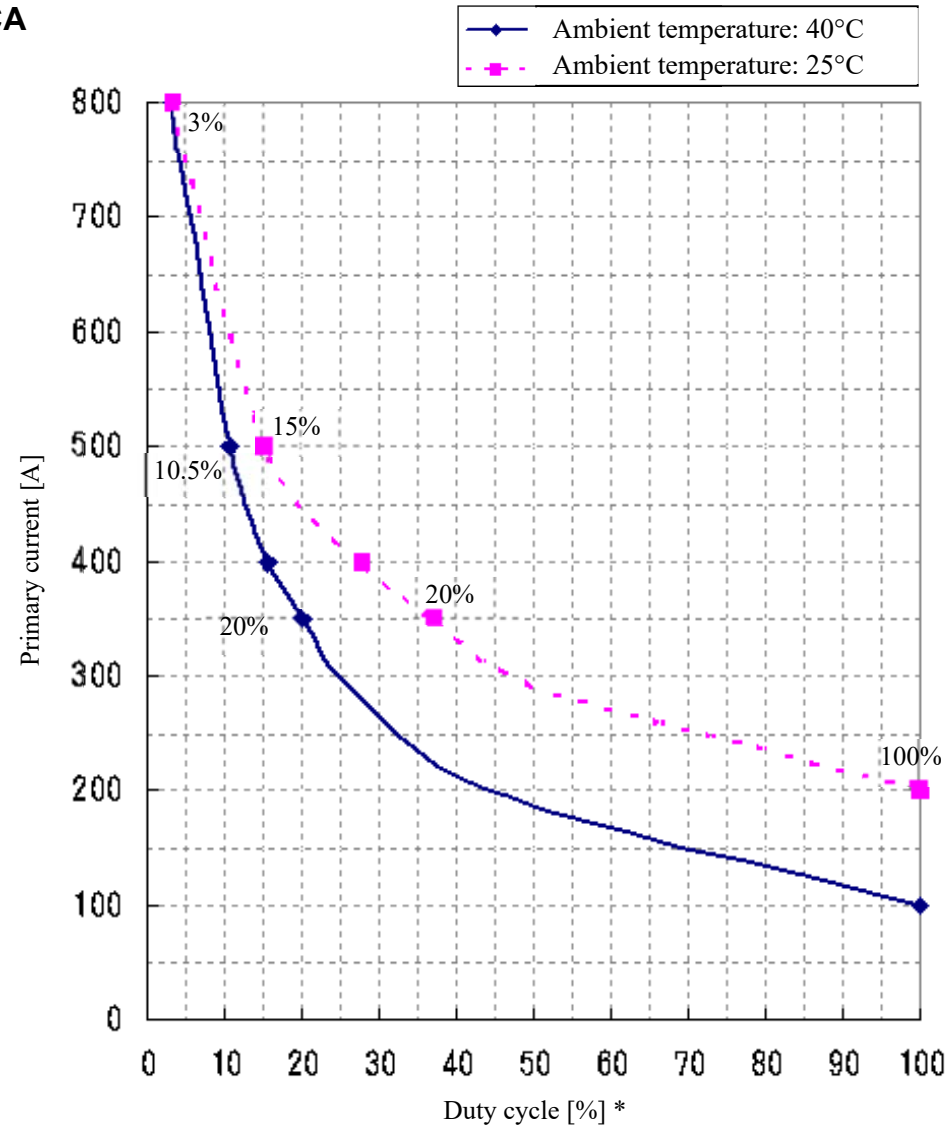
*: selectable for every 255 schedules

NOTES:

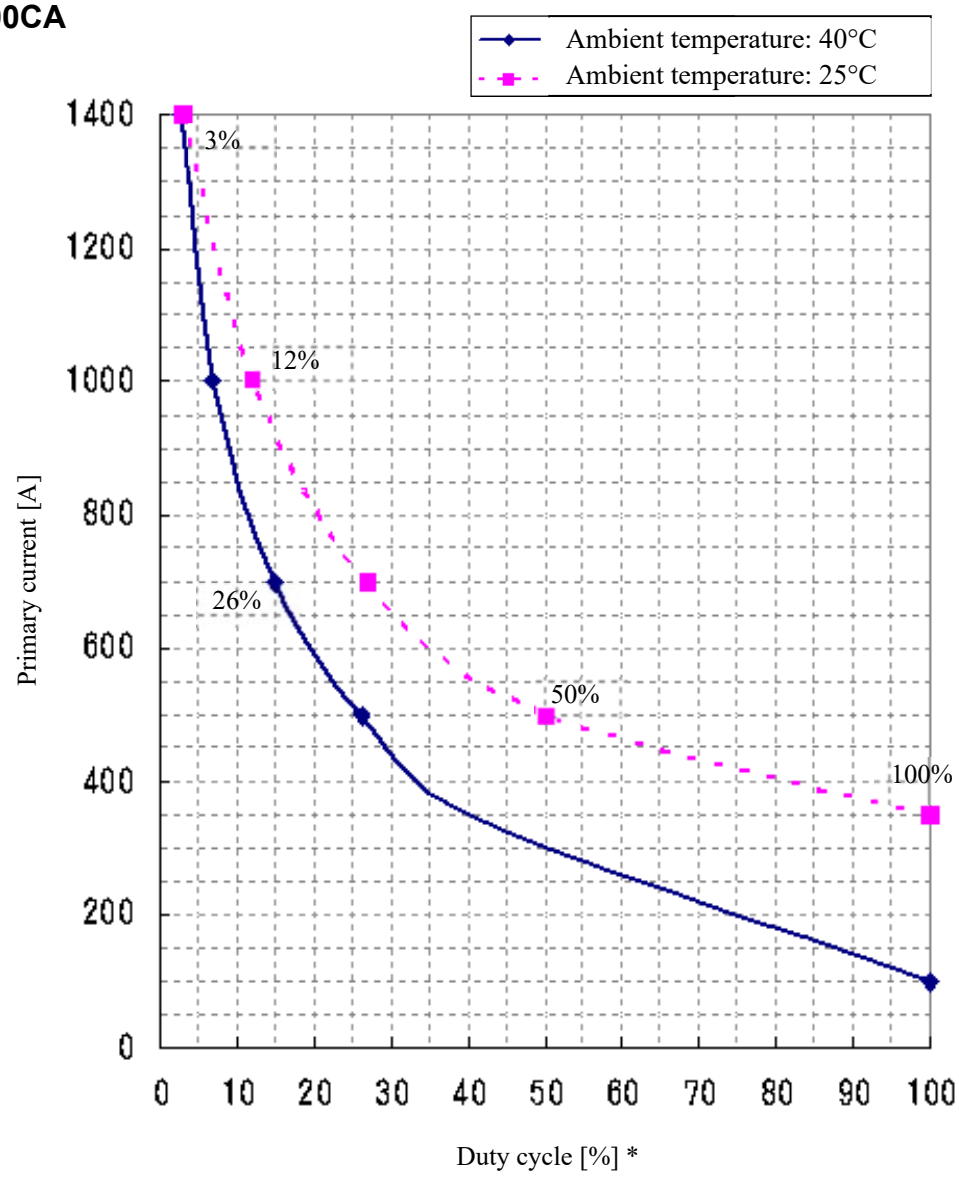
- No repetitive operation will be performed if "0" is selected for OFF (off time).
- Primary current can be set up to 800 A for **IS-800CA** and 1400 A for **IS-1400CA**.
- Using the fixed load and the specified transformer
  - The weld time is 100 ms. The measurement range is from 60 ms to 100 ms.
  - The voltage may be out of the range due to the induced electromotive force.

Duty Cycles

IS-800CA



ISA-1400CA



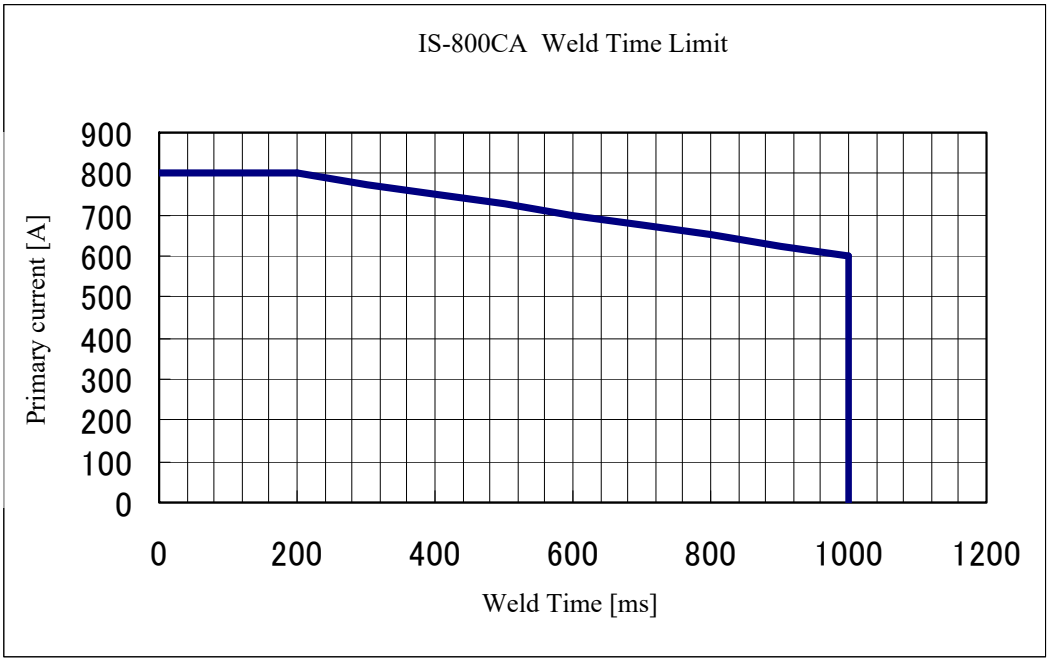
* This duty cycle graph is applied when the frequency is set to 1 kHz. Decrease the duty cycle by 0.5% (from the above graph) for each additional 100 Hz of frequency. (Example: when the frequency is increased to 3 kHz, the duty cycle needs to be decreased by 10%.)

Weld Time Limit

Use the Power Supply with the weld time calculated with the following formula or less for the primary current.

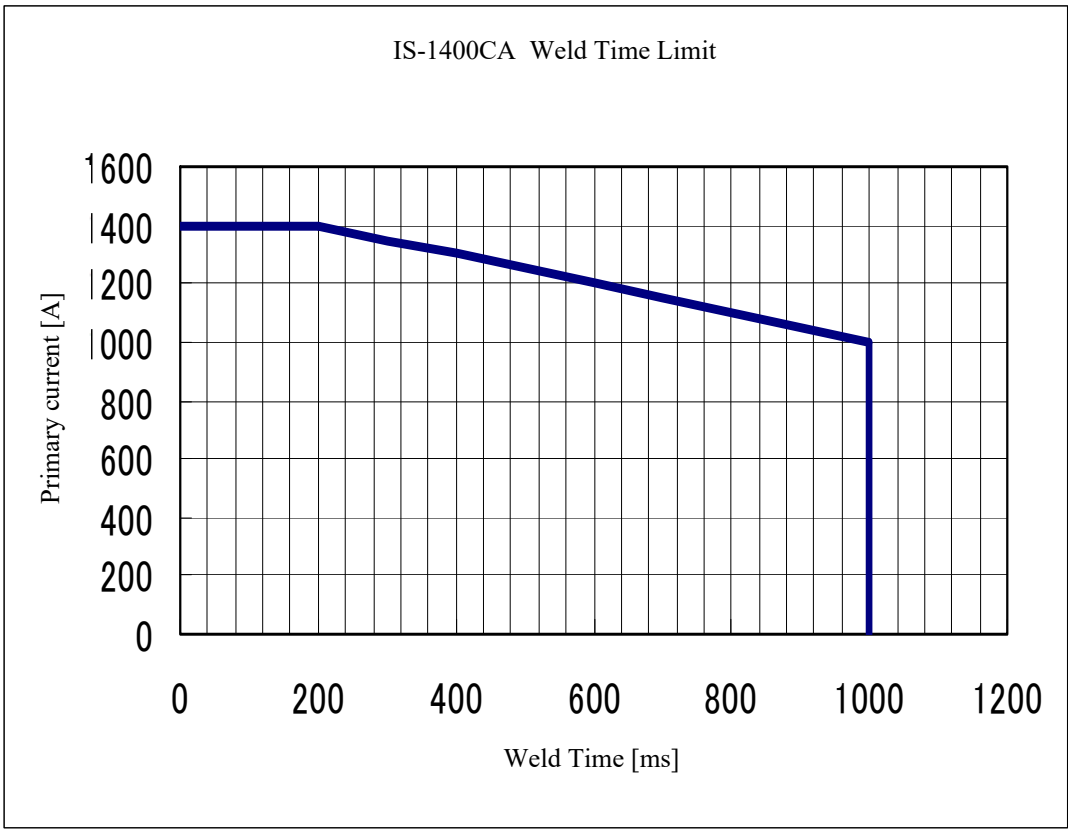
IS-800CA: For 600 A or more of the primary current, the maximum weld time [ms] = -4 × (IGBT primary current value) + 3400.

Example: Primary current is 700 A on **IS-800CA**-4 × 700 + 3400 = 600 [ms].
Therefore, the maximum weld time is 600 ms.



IS-1400CA: For 1000 A or more of the primary current
Maximum weld time [ms] = -2 × (IGBT primary current value) + 3000

Example: Primary current is 1100 A on **IS-1400CA**-2 × 1100 + 3000 = 800 [ms].
Therefore, the maximum weld time is 800 ms.

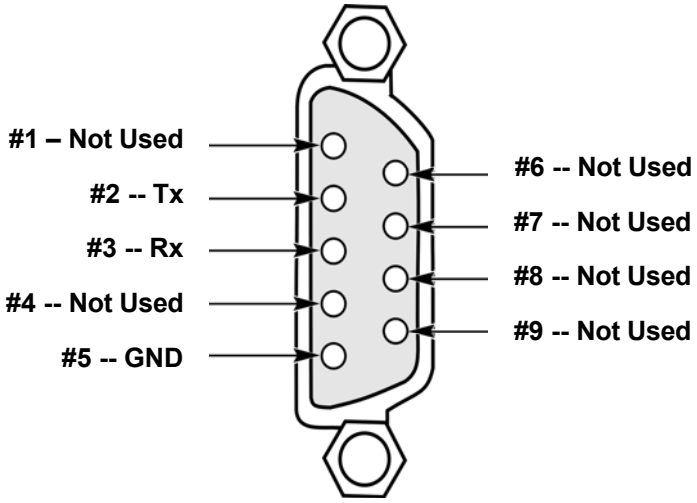


APPENDIX B
ELECTRICAL AND DATA CONNECTIONS

CAUTION
Use the shielded cable for the external input/output signals and connect the shielded part to the ground.

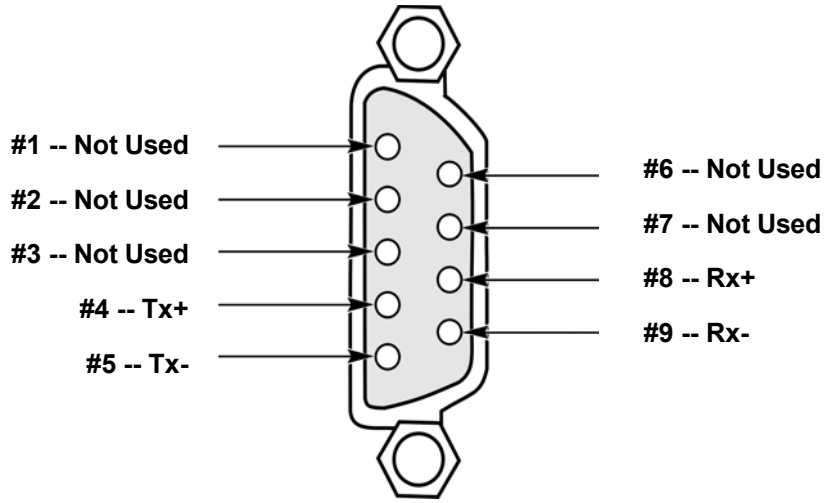
Section I. Data Connectors

RS-232 (standard): one DB-9 (female) connector wired as follows:



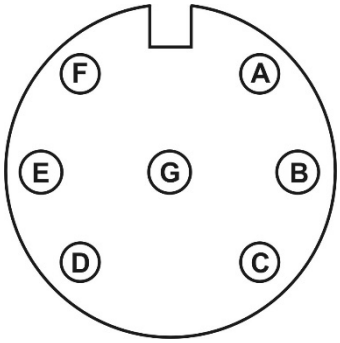
RS-232 only allows one Power Supply at a time to be connected to a host.

RS-485 (optional): two DB-9 (female) connector wired as follows:



RS-485 allows multiple Power Supplies to be daisy chained to a host.

TRANSFORMER SENSING CONNECTOR



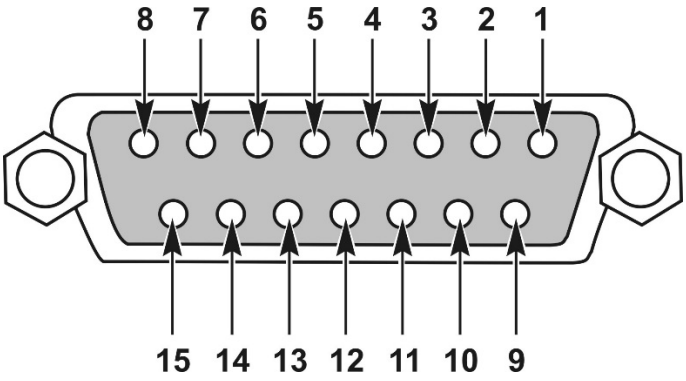
FRONT VIEW

PIN	DESCRIPTION
A	Common (Thermostat)
B	Thermostat
C	Voltage
D	Current
E	Current
F	Voltage
G	Ground

DISPLACEMENT SENSOR CONNECTOR (Advanced Models ONLY)

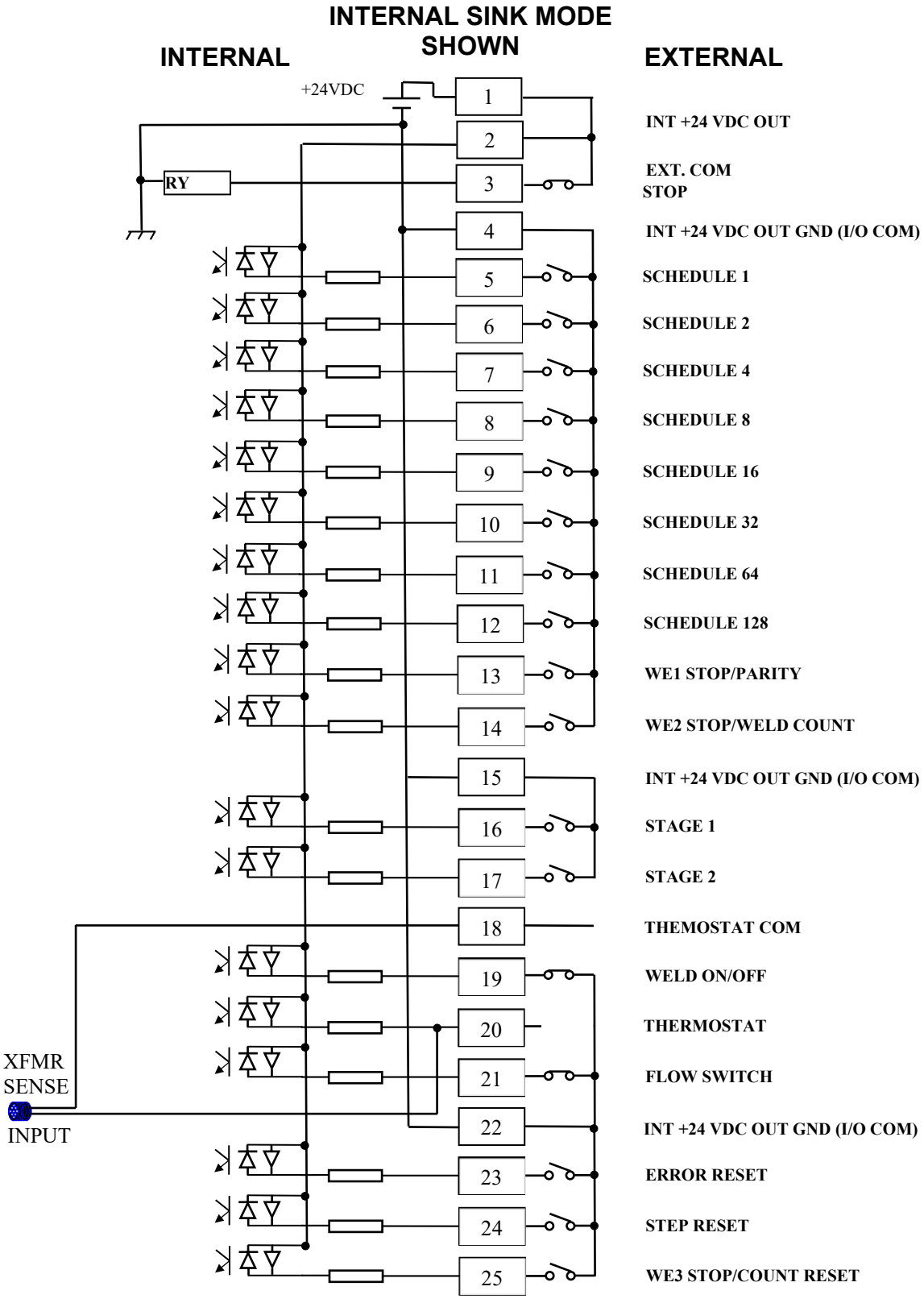
Recommended Displacement Sensor: Heidenhain St3078

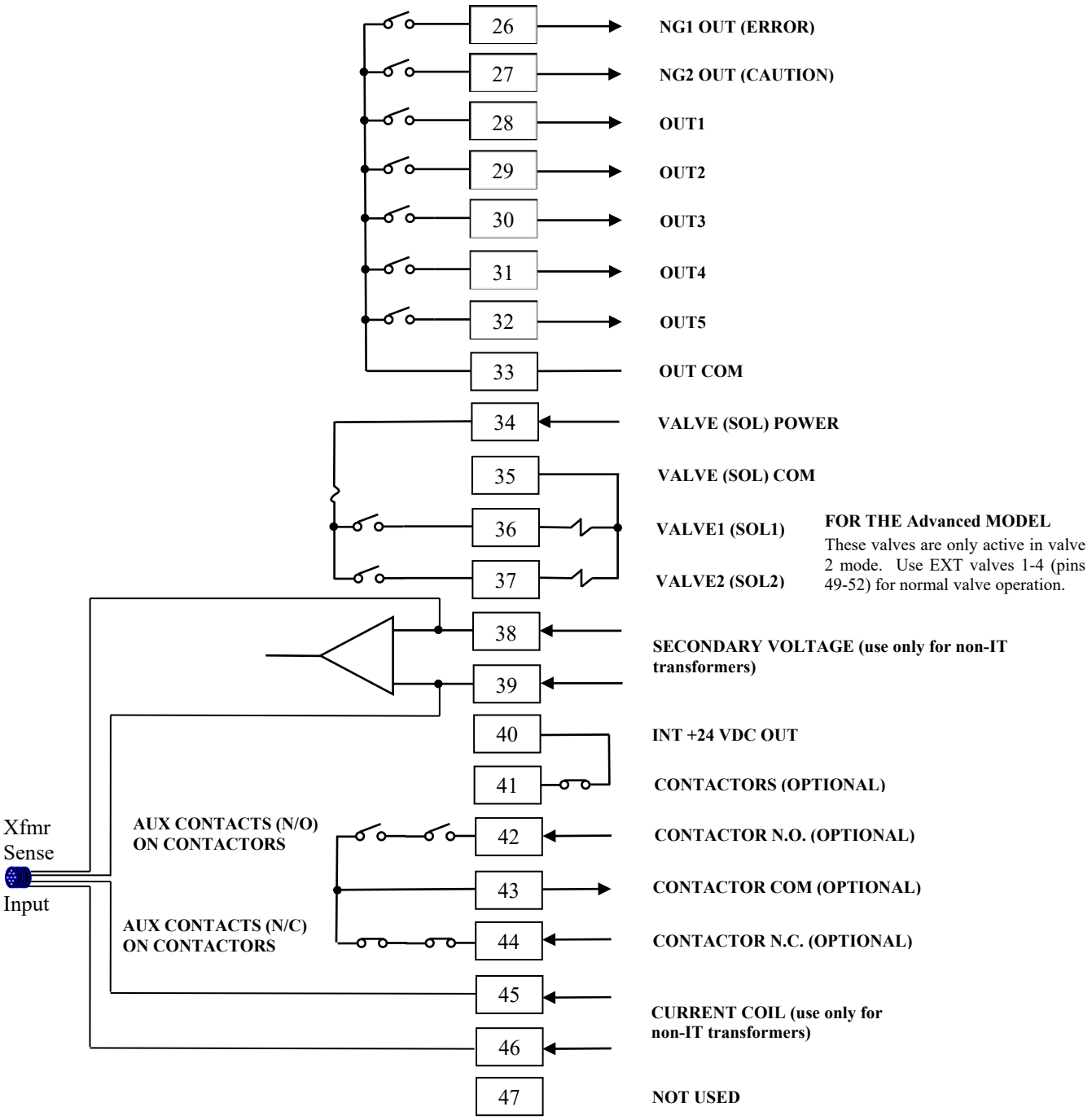
15-pin D-sub (female)



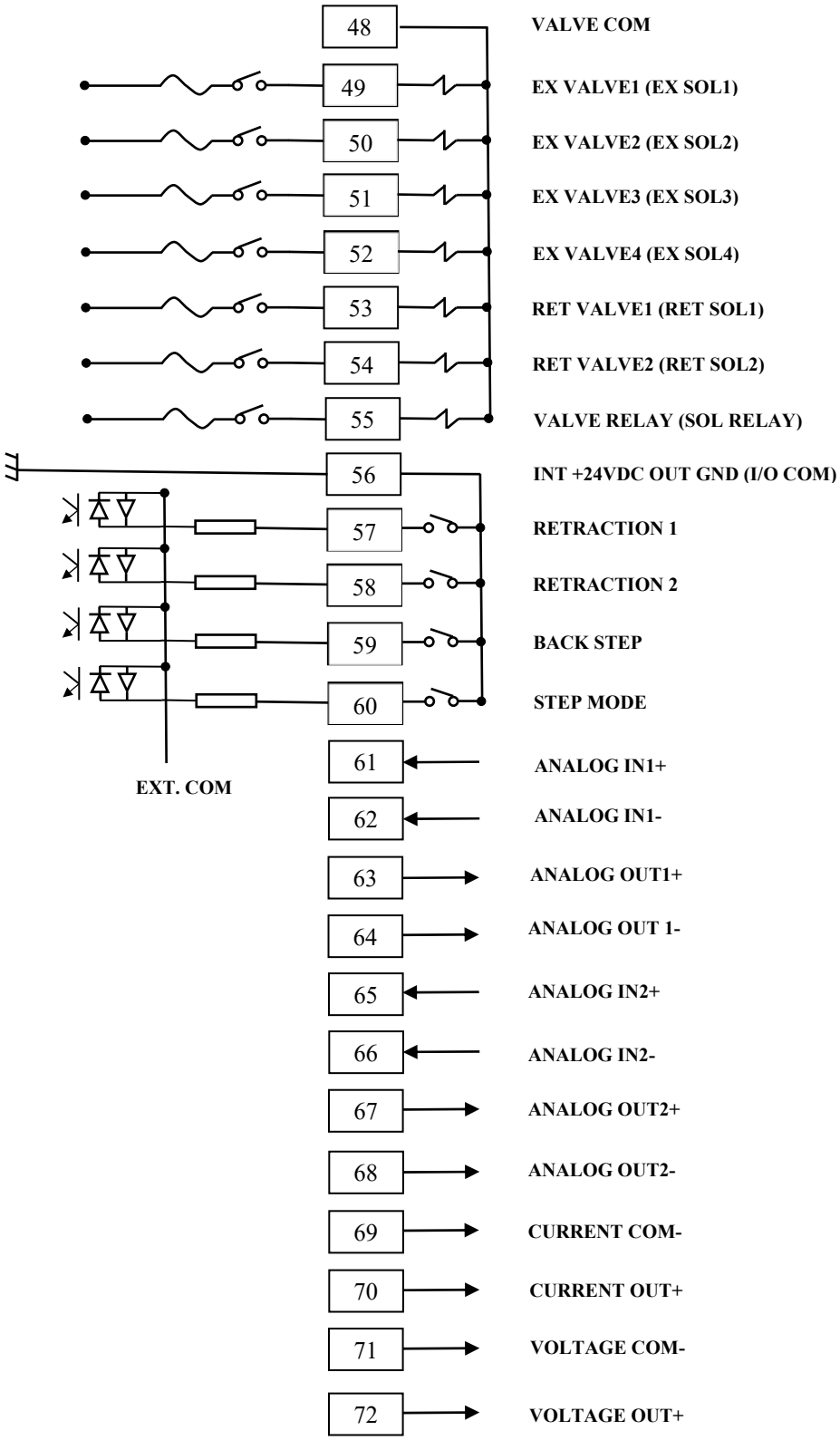
PIN	DESCRIPTION
1	A_{sig}
2	GROUND
3	B_{sig}
4	5 VOLT
5-8	UNUSED
9	A'sig
10	GROUND
11	B'_{sig}
12	5 VOLT
13-15	UNUSED

I/O Terminal Block (Basic and Advanced Models)




26
NG1 OUT (ERROR)
27
NG2 OUT (CAUTION)
28
OUT1
29
OUT2
30
OUT3
31
OUT4
32
OUT5
33
OUT COM
34
VALVE (SOL) POWER
35
VALVE (SOL) COM
36
VALVE1 (SOL1)
37
VALVE2 (SOL2)
FOR THE Advanced MODEL
These valves are only active in valve 2 mode. Use EXT valves 1-4 (pins 49-52) for normal valve operation.
38
SECONDARY VOLTAGE (use only for non-IT transformers)
39
40
INT +24 VDC OUT
41
CONTACTORS (OPTIONAL)
Xfmr Sense Input
AUX CONTACTS (N/O) ON CONTACTORS
42
CONTACTOR N.O. (OPTIONAL)
43
CONTACTOR COM (OPTIONAL)
AUX CONTACTS (N/C) ON CONTACTORS
44
CONTACTOR N.C. (OPTIONAL)
45
CURRENT COIL (use only for non-IT transformers)
46
47
NOT USED

I/O Connections for IS-800CA/1400CA Advanced Models ONLY



External I/O Signals for IS-800CA/1400CA Advanced Models ONLY

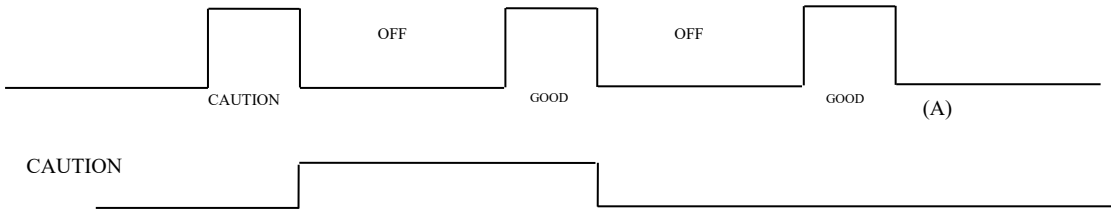
PIN	NAME	DESCRIPTION
1	INT +24 VDC OUT	**NOTE:** Do not use pin 1 unless connecting it to pin 2 or 3. Failure to observe this precaution will result in malfunction. **MAX CURRENT DRAW:** 100 mA
2	EXT. COM	For internal Sink (pull down) Connect to pin 1. For Internal Source (push up) Connect to pin 4. To activate input in Sink Mode, connect inputs to INT +24 VDC GND (I/O COM) To activate input in Source Mode, connect inputs to INT +24 VDC For External Sink attach PLC +24 V. For External Source, attach PLC COM
3	STOP	Must be jumpered to Pin 1 to operate. Use relay to provide switch closure if required
4	INT +24 VDC GND (I/O COM)	COM pin. This pin is internally connected to the internal +24 VDC GND. NOTE: DO NOT CONNECT TO PIN 1 (INT +24 VDC OUT)
		Schedule input pins:
5	SCHEDULE 1	5: Schedule 1;
6	SCHEDULE 2	6: Schedule 2;
7	SCHEDULE 4	7: Schedule 4;
8	SCHEDULE 8	8: Schedule 8;
9	SCHEDULE 16	9: Schedule 16;
10	SCHEDULE 32	10: Schedule 32
11	SCHEDULE 64	11: Schedule 64;
12	SCHEDULE 128	12: Schedule 128
13	WE1 STOP / PARITY	WE1 stop input or Parity input pin. <u>When WE1 STOP is selected</u> Closing this pin during the WELD1 sequence will switch the sequence to COOL1. The interrupt error occurs when the WELD1 STOP signal is input before the start signal is input. When this pin is closed before WELD1 welding start after startup, the current is supplied for at least a control cycle and WELD1 is stopped to switch the sequence to COOL1. <u>When PARITY CHECK is selected</u> This pin allows for detection of failure resulting from a wire break in the schedule selection signal lines. Be sure that the total number of closed schedule selection and parity signal lines is always odd.

PIN	NAME	DESCRIPTION
14	WE2 STOP/ WELD COUNT	WE2 stop input or Weld count input pin. When WE2 STOP is selected Closing this pin during the WELD2 sequence will switch the sequence to COOL2. Closing this pin in the sequence other than WELD2 is neglected. The sequence will switch to COOL2 if this signal is closed during the WELD2 sequence operation. When this pin is closed before WELD2 welding start after startup, the current is supplied for at least a control cycle and WELD2 is stopped to switch the sequence to COOL2. When WELD COUNT is selected This pin allows you to determine whether or not the number of deposited welds has reached the WELD COUNT setting. 20ms or more is required for receiving the WELD COUNT input signal.
15	INT +24VDC GND (I/O COM)	COM pin. This pin is internally connected to the +24 VDC GND
16	STAGE1	1ST STAGE input pin. Closing this pin will close SOL1 of pin 36 or SOL2 of pin 37. Since the welding sequence does not start, you can adjust or check the position. When the 2ND STAGE pin is closed after this, a welding can be done.
17	STAGE2	2ND STAGE input pin. Closing this pin will start the sequence.
18	THERMOSTAT COM	Common input for Transformer Thermostat through the XFMR Sense connector For Internal Sink operation, connect to INT +24 VDC GND (I/O Com) For internal Source operation, connect to INT+24 VDC For External Sink, connect to PLC COM For External source, connect to PLC +24 V
19	WELD ON/OFF	Weld ON pin. Close this pin to turn ON the WELD ON/OFF signal, and open it to turn it OFF. Leaving this pin open will shut off welding current even when the sequence operation is performed. Use this pin, for example, to start the sequence experimentally.
20	THERMOSTAT	If the XFMR Sense connector is not used, this pin should be connected to the appropriate voltage (Sink or Source) If the Sense connector is used this pin should be left open.
21	FLOWSWITCH	Flow switch input pin. Opening this pin will result in a flow rate error.
22	INT +24 VDC GND (I/O COM)	COM pin. This pin is internally connected to the +24 VDC GND.
23	ERROR RESET	Error/caution reset input pin. Eliminate the cause of error or caution and close this pin to reset the error or caution indication. 20ms or more is required for receiving the input signal.

PIN	NAME	DESCRIPTION
24	STEP RESET	Step reset input pin. Closing this pin while the STEPPER is ON will reset the STEP number to 1. 20 ms or more is required for receiving the input signal.
25	WE3 STOP/ COUNT RESET	WE3 stop input or Count reset input pin. When WE3 STOP is selected Closing this pin during the WELD3 sequence will switch the sequence to HOLD. The interrupt error occurs when the WELD3 STOP signal is input before the start signal is input. When this pin is closed before WELD3 welding start after startup, the current is supplied for at least a control cycle and WELD3 is stopped to switch the sequence to HOLD. When COUNT RESET is selected Closing this pin allows you to reset the counter. 20 ms or more is required for receiving the COUNT RESET input signal.
26	NG1 OUT (ERROR)	Error signal output pin. This signal is output upon completion of the welding sequence in the event of an operational error. If an error occurs, operation will halt until the reset signal is input. In NORMAL CLOSE, the pin is closed with the power turned on, but becomes open with an error occurring. In NORMAL OPEN, the pin is open with the power turned on, but becomes closed with an error occurring. The contact is rated at 24 VDC at 20 mA (semiconductor switch).
27	NG2 OUT (CAUTION)	Caution signal output pin. This pin is closed upon completion of the welding sequence if the measured value is outside the range set on the MONITOR SET screen. (In the case CAUTION is set, the status will be “ERROR” depending on the NG SIGNAL SELECT setting.) You can continue with your welding task even if a caution signal is activated. To cancel this caution output, input the reset or start signal. The contact is rated at 24 VDC at 20 mA (semiconductor switch). In the case the off time (OFF) is set, when CAUTION is output, the signal is maintained until the next welding result is obtained. (*1)
28	OUT1	Contact output pins. (semiconductor switch. The contact is rated at 24 VDC at 20 mA.) The contact is open or closed corresponding to the function. Can be assigned to each pin. END,COUNT ERROR,READY,STEP END,WELD SIGNAL,GOOD,COUNT UP,OUT I,OUT II
29	OUT2	
30	OUT3	
31	OUT4	
32	OUT5	
33	OUT COM	Common pin for output pins. This pin is the common pin for the NG, CAUTION, END, COUNT ERROR, READY, STEP END, and WELD ON pins.

PIN	NAME	DESCRIPTION
34	VALVE (SOL) POWER	Power input pins to drive the solenoid valve. Input 120 VAC or 24 VDC power.
35	VALVE (SOL) COM	COM pin for the solenoid valve.
36 **37**	VALVE1 (SOL1) VALVE2 (SOL2)	Solenoid valve output pins. 36: VALVE1 (SOL1); 37: VALVE2 (SOL2) These pins are closed for the duration of the STAGE 2 input. Output between SQD and HOLD. When the off time (OFF) is set, this pin is output between SQZ and HOLD after the second sequence. The contacts are rated at 120 VAC or 24 VAC/DC at 0.5 A (semiconductor switches). Use a solenoid valve with a current capacity of 0.5 A or less.
38 **39**	SECONDARY VOLTAGE	Secondary voltage input pins. Internally connected to the IT XFMR sense connector. If IT XFMR sense cable not used may be connected directly to electrodes.
40	INT +24VDC OUT	Jumpered from Pin1 to provide drive voltage to Contactor Solid State Relay
41	CONTACTORS	Switch closure between Pin 40 and Pin 41 will engage the optional contactor
42	CONTACTOR N.O.	Detect position of contactors between pin 42 and 43: contactors normally open (optional)
43	CONTACTOR COM	Contactor Aux contact common (optional)
44	CONTACTOR N.C.	Detect position of contactors between pin 44 and 43: contactors normally closed (optional)
45 **46**	CURRENT COIL	Current coil input, used for secondary current feedback. Internally connected to the IT XFMR sense connector. If XFMR sense cable not used may be connected external current coil.
47	N/A	UNUSED

*[1] When the sequence is stopped at (A), error (CAUTION) is not displayed. It's because the contents when stopped is displayed on the program unit.



*[2] Maximum combined current draw from all analog outputs: 75 mA

Pin-Out for Advanced only

PIN	NAME	DESCRIPTION
	Pin out below is for IS-800CA/1400CA Advanced only	
48	VALVE COM	COMMON for all valves
49 **50** **51** **52** **53** **54** **55**	EX VALVE1 (EX SOL1) EX VALVE2 (EX SOL2) EX VALVE3 (EX SOL3) EX VALVE4 (EX SOL4) RET VALVE1 (RET SOL1) RET VALVE2 (RET SOL2) VALVE RELAY (SOL RELAY)	Solenoid valve output pins. TB6 5: EX VALVE1 (EX SOL1); TB6 6: EX VALVE2 (EX SOL2); TB6 7: EX VALVE (EX SOL3); TB6 8: EX VALVE4 (EX SOL4) TB6 9: RETRACTION VALVE1 (RET SOL1); TB6 10: RETRACTION VALVE2 (RET SOL2); TB6 11: VALVE RELAY (SOL RELAY) The contacts are rated at 120 VAC or 24 VAC/DC at 0.5 A (semiconductor switches). Use a solenoid valve with a current capacity of 0.5 A or less. Retraction Solenoid valve output pins. NOTE: when using DC solenoid see note *3
56	INT +24VDC GND (I/O COM)	COM pin. This pin is internally connected to the +24 VDC GND
57 **58** **59** **60**	RETRACTION 1 RETRACTION 2 BACK STEP STEP MODE	
61 **62**	ANALOG IN1+ ANALOG IN1-	0 – 10 VDC Analog input 1
63 **64**	ANALOG OUT1+ ANALOG OUT1-	0 – 10 VDC Analog output 1*2
65 **66**	ANALOG IN2- ANALOG IN2-	0 – 10 VDC Analog input 2
67 **68**	ANALOG OUT2+ ANALOG OUT2-	0 – 10 VDC Analog output 2*2
69 **70**	CURRENT COM- CURRENT OUT+	Current output (0 – 10 VDC)*2 $V_{OUT} = I_{OUT} / 5000$
71 **72**	VOLTAGE COM- VOLTAGE OUT+	Voltage output (0 – 10 VDC)*2 $V_{OUT} = V_{FEEDBACK} / 2$

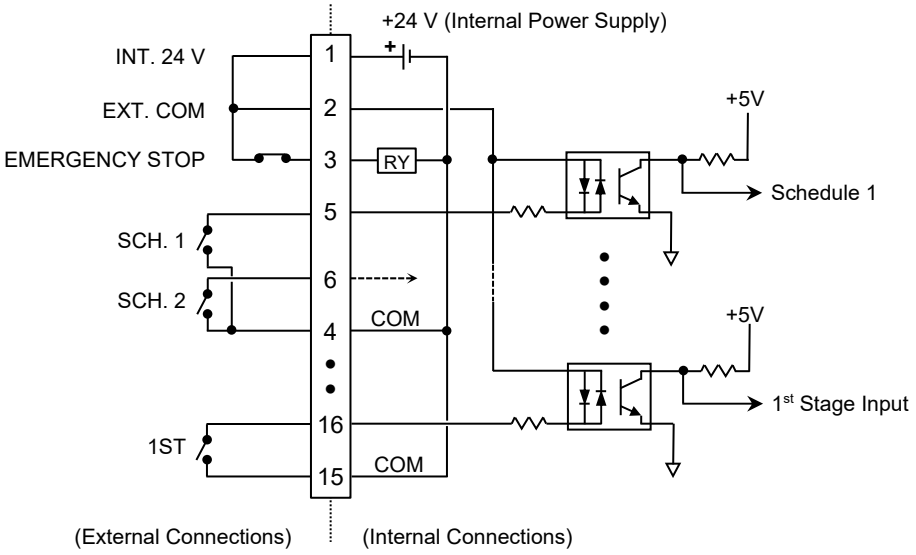
External Output Signals

The following signals can be assigned on the **OUTPUT SELECT** screen to output pins 28 to 32 (OUT1 to 5)

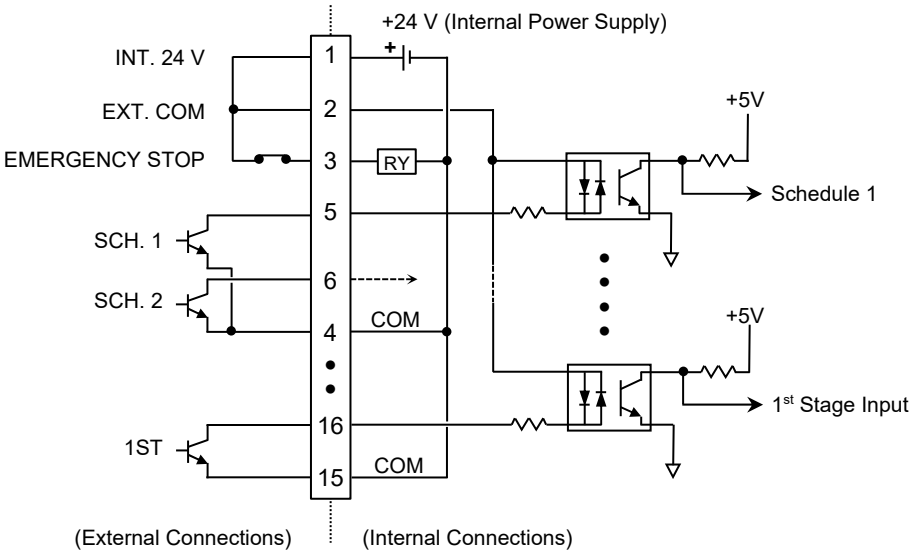
NAME	DESCRIPTION
END	Closed each time the sequence is complete and output the END signal. Output time selection (10 to 200 ms, HOLD) When the off time (OFF) is set and the END signal time is set to time longer than OFF time, the END signal time will be equal to OFF time.
COUNT ERROR	Weld count error output. In the case WELD COUNT is ON, this signal is closed when the weld count terminal is open before the set number of welds is not deposited. This signal is also closed when the weld count terminal is open before welds are counted. When the weld count is larger than the set number of welds, this signal is not output. To clear the count error signal, you need to input the weld count signal again or add required number of welds to make up for insufficiency. The count error signal is not cleared if the error reset signal is input. Also, when required number of welds are added to make up for insufficiency, the count error signal is output until the insufficient number of welds is complete.
READY	Closed when no error occurs and the WELD ON/OFF is ON.
STEP END	Closed when the last step ends in step-up operation. Closed until the step reset signal is input or the step setting (value) is changed. Even if VALVE1 and VALVE 2 are switched, the signal remains closed when the either one reaches the set number of welds. The error is displayed only when the VALVE where the current is supplied has reached (reaches) the set number of welds.
WELD SIGNAL	Welding timing signal. Closed during welding. Not output at COOL. Closed even if start with the WELD OFF state (with time set and HEAT not set).
GOOD	Closed when the measured value is judged to be within the range set on the MONITOR SET screen after the completion of welding sequence. Output time selection: 10 to 200 ms, 0 ms (Hold)
COUNT UP	Closed when the count reaches the preset counter value. To cancel the count up output, input the reset signal to the count reset pin.
OUT I	WELD1 weld end output. Closed between the WELD1 weld end and the beginning of HOLD.
OUT II	WELD2 weld end output. Closed between the WELD2 weld end and the beginning of HOLD.

Input Signal Connections

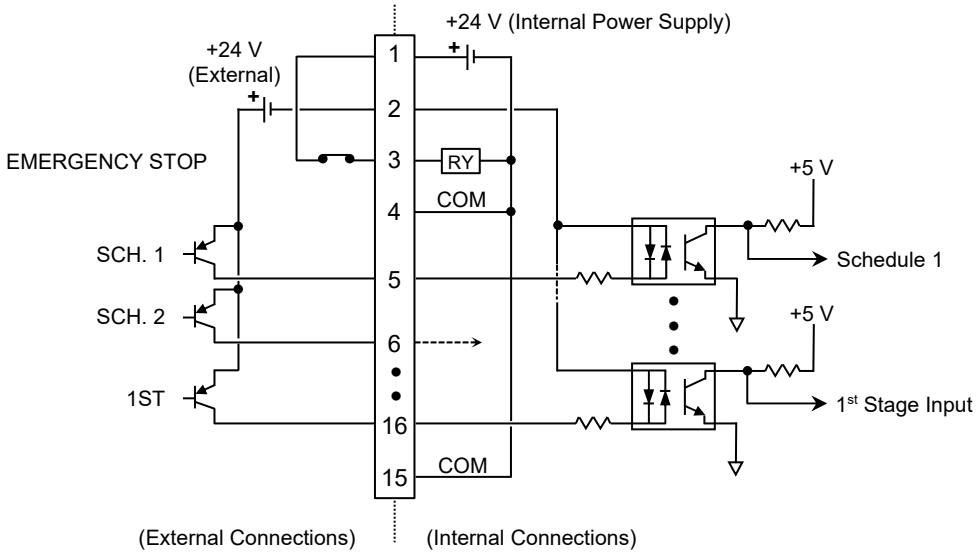
1. Connection with equipment having a contact input. Connect pins 1 and 2.



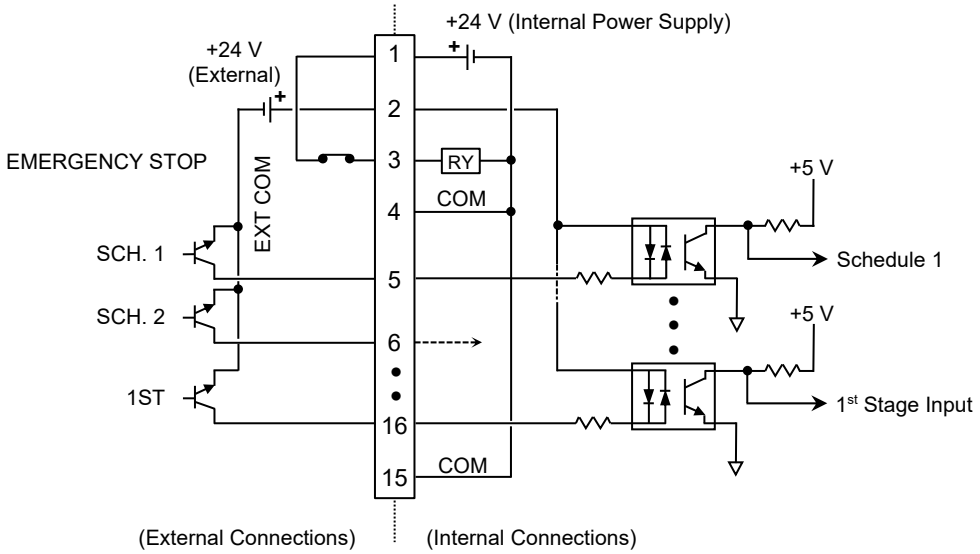
2. Connection with equipment featuring NPN (sink) open collector output using internal +24 VDC power supply. Connect pins 1 and 2.



3. Connection with equipment featuring PNP (source) current output using external power supply. Connect the negative side of an external 24 VDC power supply to pin 2.



4. Connection with equipment featuring NPN (sink) open collector output using external power supply. Connect the positive side of an external 24 VDC power supply to pin 2.

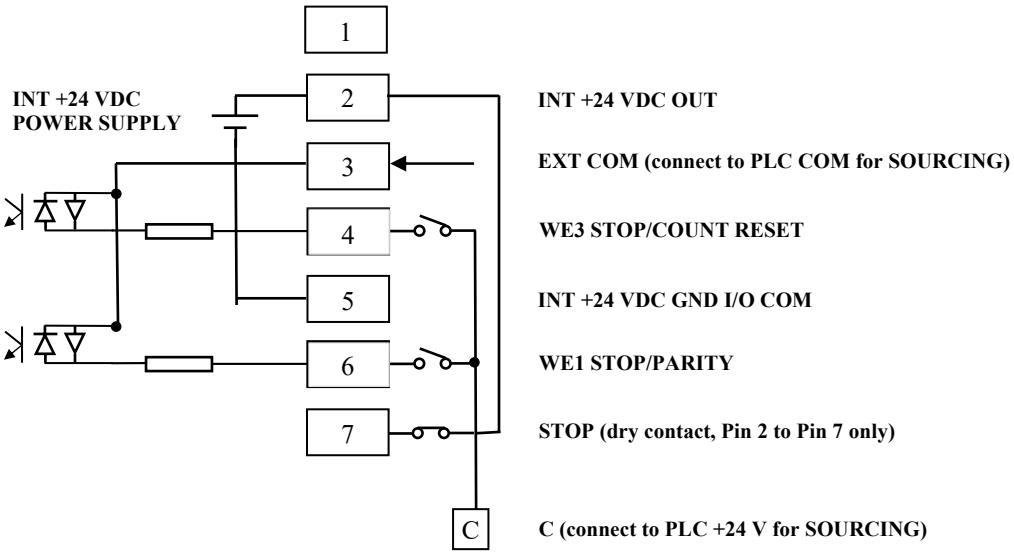


I/O Wiring for IS-800CA/1400CA CASCADE Model

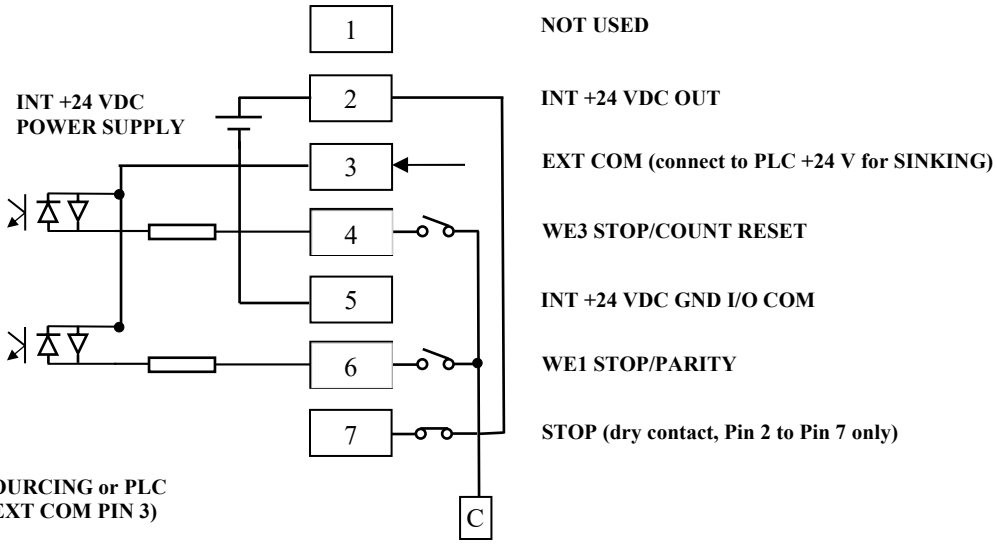
I/O wiring example

Switches connected to "C" connections can be dry contact or direct input from PLC channels.

PLC +24 V SOURCING

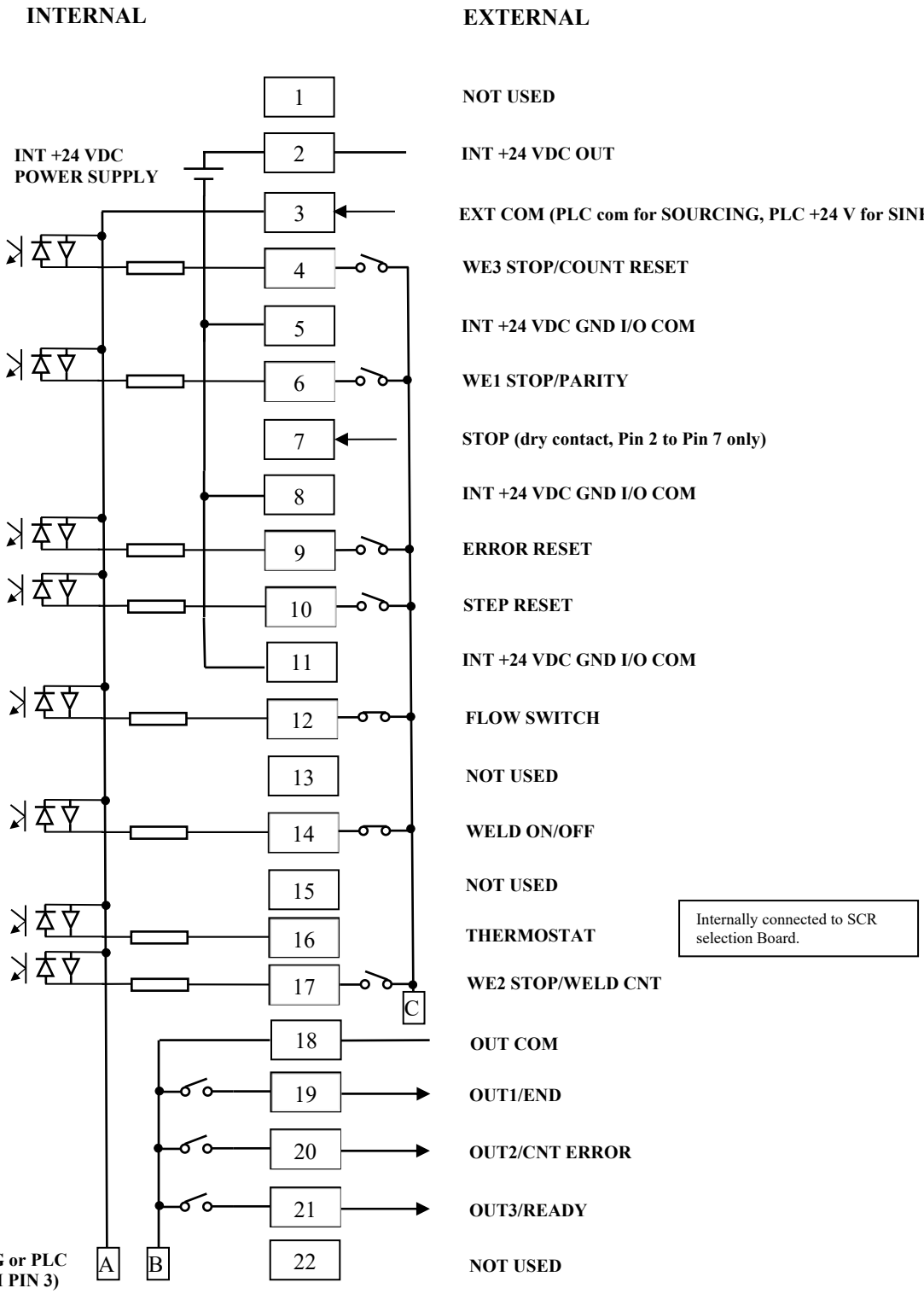


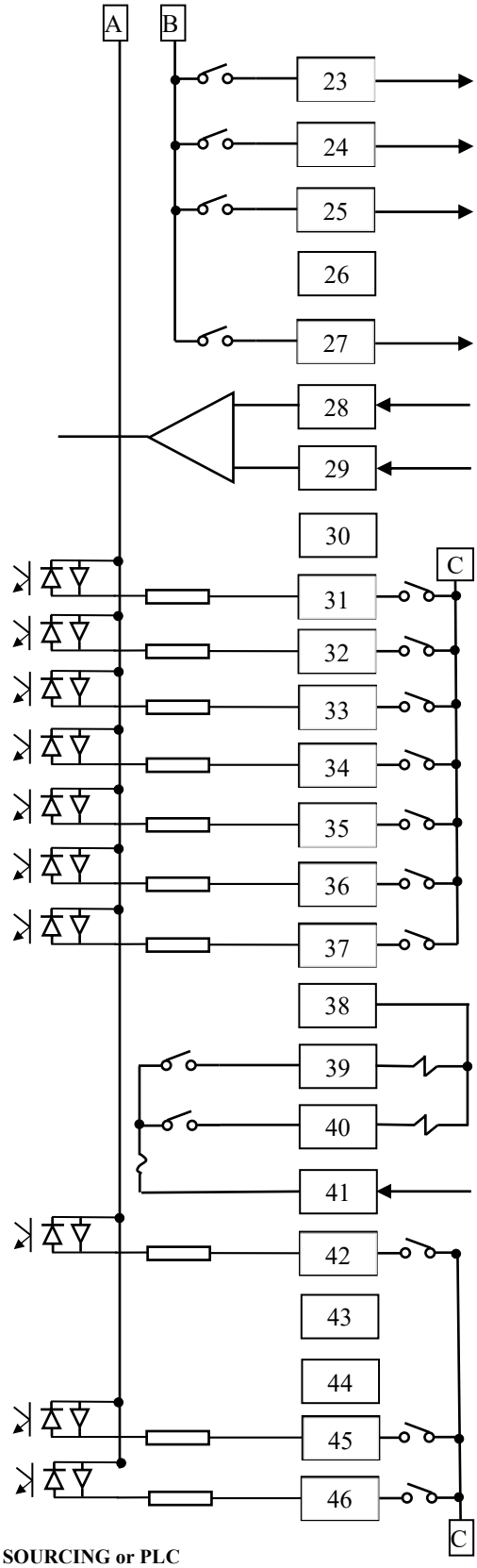
PLC +24 V SINKING



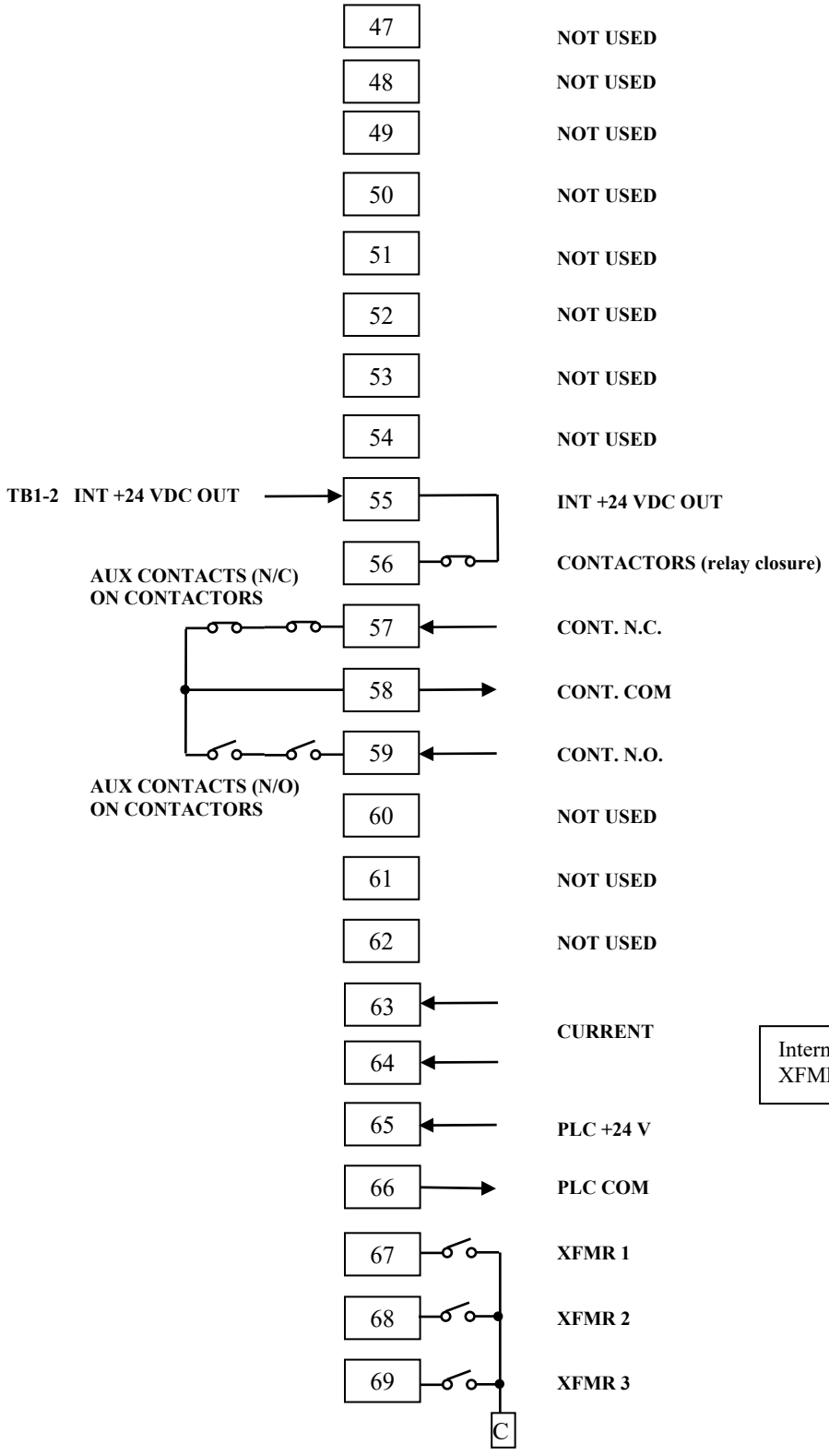
NOTE: "C" = PLC +24 V for SOURCING or PLC COM for SINKING relative to EXT COM PIN 3)

I/O Terminal Block (CASCADE Model)

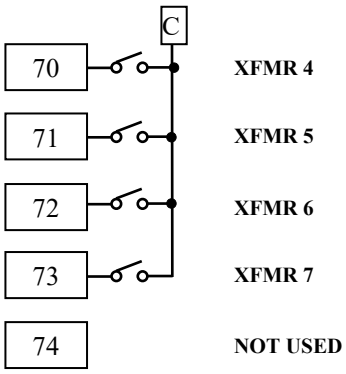




NOTE: "C" = PLC +24 V for SOURCING or PLC COM for SINKING relative to EXT COM PIN 3)


47
NOT USED
48
NOT USED
49
NOT USED
50
NOT USED
51
NOT USED
52
NOT USED
53
NOT USED
54
NOT USED
TB1-2 INT +24 VDC OUT
55
INT +24 VDC OUT
56
CONTACTORS (relay closure)
AUX CONTACTS (N/C)
ON CONTACTORS
57
CONT. N.C.
58
CONT. COM
59
CONT. N.O.
AUX CONTACTS (N/O)
ON CONTACTORS
60
NOT USED
61
NOT USED
62
NOT USED
63
CURRENT
64
65
PLC +24 V
66
PLC COM
67
XFMR 1
68
XFMR 2
69
XFMR 3
C
Internally connected to
XFMR sense connector.

NOTE: "C" = PLC +24 V for SOURCING or PLC COM for SINKING relative to EXT COM PIN 3)



External I/O Signals for cascade models

PIN	NAME	DESCRIPTION
1	NOT USED	
2	INT +24VDC OUT	INTERNAL +24 VDC present. USE ONLY for STOP function (Pin 7) Relay Closure
3	EXT COM	Use to set up I/O inputs for 24 VDC SOURCING or SINKING SOURCING: connect PLC COM SINKING: connect PLC +24 V
4	WE3 STOP/ COUNT RESET	WE3 stop input or Count reset input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Switch between functions via the settings on the **MODE SELECT screen** When WE3 STOP is selected Closing this pin during the WELD3 sequence will switch the sequence to HOLD. The interrupt error occurs when the WELD3 STOP signal is input before the start signal is input. When this pin is closed before WELD3 welding start after startup, the current is supplied for at least a control cycle and WELD3 is stopped to switch the sequence to HOLD. When COUNT RESET is selected Closing this pin allows you to reset the counter. 20 ms or more is required for receiving the COUNT RESET input signal.
5	INT +24VDC GND I/O COM	INT I/O COM pin. This pin is internally connected to the +24 VDC ground.
6	WE1 STOP/ PARITY	WE1 stop input or Parity input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Switch between functions via the settings on the **MODE SELECT screen** When WE1 STOP is selected Closing this pin during the WELD1 sequence will switch the sequence to COOL1. The interrupt error occurs when the WELD1 STOP signal is input before the start signal is input. When this pin is closed before WELD1 welding start after startup, the current is supplied for at least a control cycle and WELD1 is stopped to switch the sequence to COOL1. When PARITY CHECK is selected This pin allows for detection of failure resulting from a wire break in the schedule selection signal lines. Be sure that the total number of closed schedule selection and parity signal lines is always odd.
7	STOP	Connect pins 7 and 2 to enable welder. Activate to operate welder Open this pin when you wish to stop the weld sequence. Open for 20 ms or more to stop.

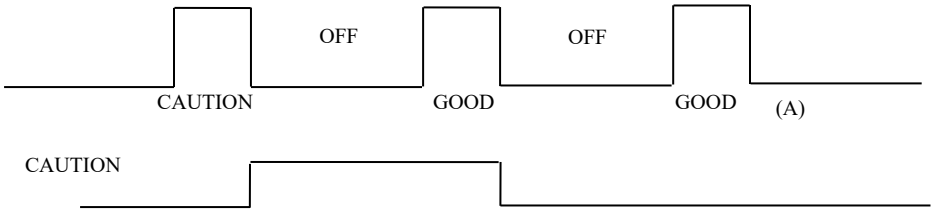
PIN	NAME	DESCRIPTION
8	INT +24VDC GND I/O COM	INT I/O COM pin. This pin is internally connected to the +24 VDC ground.
9	ERROR RESET	Error/caution reset input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Eliminate the cause of error or caution and close this pin to reset the error or caution indication. 20 ms or more is required for receiving the input signal.
10	STEP RESET	Step reset input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Closing this pin while the STEPPER is ON will reset the STEP number to 1. 20 ms or more is required for receiving the input signal.
11	INT +24VDC GND I/O COM	INT I/O COM pin. This pin is internally connected to the +24 VDC ground.
12	FLOWSWITCH	Flow switch input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Opening this pin will result in a flow rate error. 20 ms or more is required for receiving the input signal.
13	NOT USED	
14	WELD ON/OFF	Weld ON pin. Close this pin to turn ON the WELD ON/OFF signal, and open it to turn it OFF. Leaving this pin open will shut off welding current even when the sequence operation is performed. Use this pin, for example, to start the sequence experimentally. 20 ms or more is required for receiving the input signal.
15	NOT USED	
16	THERMOSTAT	Thermostat sense pin. Connected internally to the IT XFMR Sense cables. All transformer plugs must be installed.
17	WE2 STOP/ WELD COUNT	WE2 stop input or Weld count input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Switch between functions via the settings on the **MODE SELECT screen**. <u>When WE2 STOP is selected</u> Closing this pin during the WELD2 sequence will switch the sequence to COOL2. Closing this pin in the sequence other than WELD2 is neglected. The sequence will switch to COOL2 if this signal is closed during the WELD2 sequence operation. When this pin is closed before WELD2 welding start after startup, the current is supplied for at least a control cycle and WELD2 is stopped to switch the sequence to COOL2. <u>When WELD COUNT is selected</u> This pin allows you to determine whether or not the number of deposited welds has reached the WELD COUNT setting. 20 ms or more is required for receiving the WELD COUNT input signal.

PIN	NAME	DESCRIPTION
18	OUT COM	Common pin for output pins. Connect PLC COM or PLC +24 V. This pin is the common pin for the NG, CAUTION, END, COUNT ERROR, READY, STEP END, and WELD ON pins.
19	OUT1/END	Contact output pins. (semiconductor switch. The contact is rated at 24 VDC at 20 mA.)
20	OUT2/CNT ERROR	
21	OUT3/READY	
22	NOT USED	
23	NG1 OUT (ERROR)	Error signal output pin. This signal is output upon completion of the welding sequence in the event of an operational error. If an error occurs, operation will halt until the reset signal is input. In NORMAL CLOSE, the pin is closed with the power turned on, but becomes open with an error occurring. In NORMAL OPEN, the pin is open with the power turned on, but becomes closed with an error occurring. The contact is rated at 24 V DC at 20 mA (semiconductor switch).
24	NG2 OUT (CAUTION)	Caution signal output pin. This pin is closed upon completion of the welding sequence if the measured value is outside the range set on the MONITOR SET screen. (In the case CAUTION is set, the status will be “ERROR” depending on the NG SIGNAL SELECT setting.) You can continue with your welding task even if a caution signal is activated. To cancel this caution output, input the reset or start signal. The contact is rated at 24 VDC at 20 mA (semiconductor switch). In the case the off time (OFF) is set, when CAUTION is output, the signal is maintained until the next welding result is obtained.
25	OUT4/STEP	Contact output pins. (semiconductor switch. The contact is rated at 24 V DC at 20 mA.)
26	NOT USED	
27	OUT5/WELD SIG	Contact output pins. (semiconductor switch. The contact is rated at 24 V DC at 20 mA.)
28 **29**	SECONDARY VOLTAGE	Secondary voltage input pins. Internally connected to the XFMR Sense Cables
30	NOT USED	
31 **32** **33** **34** **35** **36** **37**	SCHEDULE 1 SCHEDULE 2 SCHEDULE 4 SCHEDULE 8 SCHEDULE 16 SCHEDULE 32 SCHEDULE 64	Schedule input pins. Can SOURCE with PLC +24V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) 31: Schedule 1; 32: Schedule 2; 33: Schedule 4; 34: Schedule 8; 35: Schedule 16; 36: Schedule 32; 37: Schedule 64
38	VALVE(SOL) COM	COM pin for the solenoid valve.

PIN	NAME	DESCRIPTION
39[*2] **40**[*2]	VALVE 1(SOL1) VALVE 2(SOL2)	Solenoid valve output pins. 39: VALVE 1; 40: VALVE 2 These pins are closed for the duration of the 2ND STAGE input. Output between SQD and HOLD. When the off time (OFF) is set, this pin is output between SQZ and HOLD after the second sequence. The contacts are rated at 120 VAC or 24 V AC/DC at 0.5 A (semiconductor switches). Use a solenoid valve with a current capacity of 0.5 A or less.
41	VALVE(SOL) PWR	Power input pins to drive the solenoid valve. Input 120 VAC or 24 VAC/DC power.
42	SCHEDULE 128	Schedule input pins. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL)
43	NOT USED	
44	NOT USED	
45	STAGE 1	1ST STAGE input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Closing this pin will close SOL1 of pin 39 or SOL2 of pin 40. Since the welding sequence does not start, you can adjust or check the force position. When the 2ND STAGE pin is closed after this, a welding can be done at the most appropriate force position. Maintaining the 1ST STAGE input pin ends even if it is closed, and the selected SOL signal, SOL1 or SOL2, is turned OFF. The start signal stabilizing time can be changed in the range of 1 to 20 ms. (Also applied to the 2ND signal.)
46	STAGE 2	2ND STAGE input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL) Closing this pin will start the sequence. The start signal stabilizing time can be changed in the range of 1 to 20 ms. (Also applied to the 1st signal.)
47	NOT USED	
48	NOT USED	
49	NOT USED	
50	NOT USED	
51	NOT USED	
52	NOT USED	
53	NOT USED	
54	NOT USED	
55	INT +24VDC OUT	INTERNAL +24 VDC
56	CONTACTORS	Connect Pin 55 to Pin 56 for contactor closure. Use relay if control is required
57	CONT. N.C.	Detect position of contactors between pin 57 and 58: contactors normally CLOSED

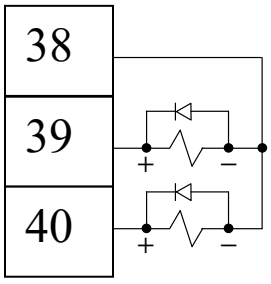
PIN	NAME	DESCRIPTION
58	CONT. COM	Contactor Aux contact common (optional)
59	CONT. N.O.	Detect position of contactors between pin 59 and 58: contactors normally OPEN
60	NOT USED	
61	NOT USED	
62	NOT USED	
63 **64**	CURRENT COIL	Internally connected to XFMR Sense Cables
65	PLC +24V	User to connect PLC +24 V
66	PLC COM	User to connect PLC COM
67 **68** **69** **70** **71** **72** **73**	XFMR1 XFMR2 XFMR3 XFMR4 XFMR5 XFMR6 XFMR7	Transformer x select input pin. Can SOURCE with PLC +24 V or SINK with PLC COM (MUST SET EXT COM PIN 3 TO OPPOSITE SIGNAL). Low Voltage transformer plug needs to be connected to cascade section. Use special jumper plug if transformer is not used.
74	NOT USED	

*1



When the sequence is stopped at (A), error (CAUTION) is not displayed. It's because the contents when stopped is displayed on the program unit.

*2 When using 24 VDC solenoid, install diodes on measures to prevent surge voltage.
Example) When inputting + to Pin 41 and – to Pin 38.



External Output Signals

The following signals can be assigned to output pins 19 to 21 (OUT1 to 3), pin 25 (OUT4) and pin 27 (OUT5) on **OUTPUT SELECT Screen**.

NAME	DESCRIPTION
END	Closed each time the sequence is complete and output the END signal. Output time selection (10 to 200 ms, HOLD) When the off time (OFF) is set and the END signal time is set to time longer than OFF time, the END signal time will be equal to OFF time
COUNT ERROR	Weld count error output. In the case WELD COUNT is ON, this signal is closed when the weld count terminal is open before the set number of welds is not deposited. This signal is also closed when the weld count terminal is open before welds are counted. When the weld count is larger than the set number of welds, this signal is not output. To clear the count error signal, you need to input the weld count signal again or add required number of welds to make up for insufficiency. The count error signal is not cleared if the error reset signal is input. Also, when required number of welds are added to make up for insufficiency, the count error signal is output until the insufficient number of welds is complete.
READY	Closed when no error occurs and the WELD ON/OFF is ON.
STEP END	Closed when the last step ends in step-up operation. Closed until the step reset signal is input or the step setting (value) is changed. Even if VALVE1 and VALVE 2 are switched, the signal remains closed when the either one reaches the set number of welds. The error is displayed only when the VALVE where the current is supplied has reached (reaches) the set number of welds.
WELD SIGNAL	Welding timing signal. Closed during welding. Not output at COOL. Closed even if start with the WELD OFF state (with time set and HEAT not set).
GOOD	Closed when the measured value is judged to be within the range set on the MONITOR SET screen after the completion of welding sequence. Output time selection: 10 to 200 ms, 0 ms (Hold)
COUNT UP	Closed when the count reaches the preset counter value. To cancel the count up output, input the reset signal to the count reset pin.
OUT I	WELD1 welding end output. Closed between the WELD1 welding end and the beginning of HOLD.
OUT II	WELD2 welding end output. Closed between the WELD2 welding end and the beginning of HOLD.

APPENDIX C
SYSTEM TIMING

Input and Output Timing Signals

The following illustrations show the timing signals for different functions of the Power Supply.

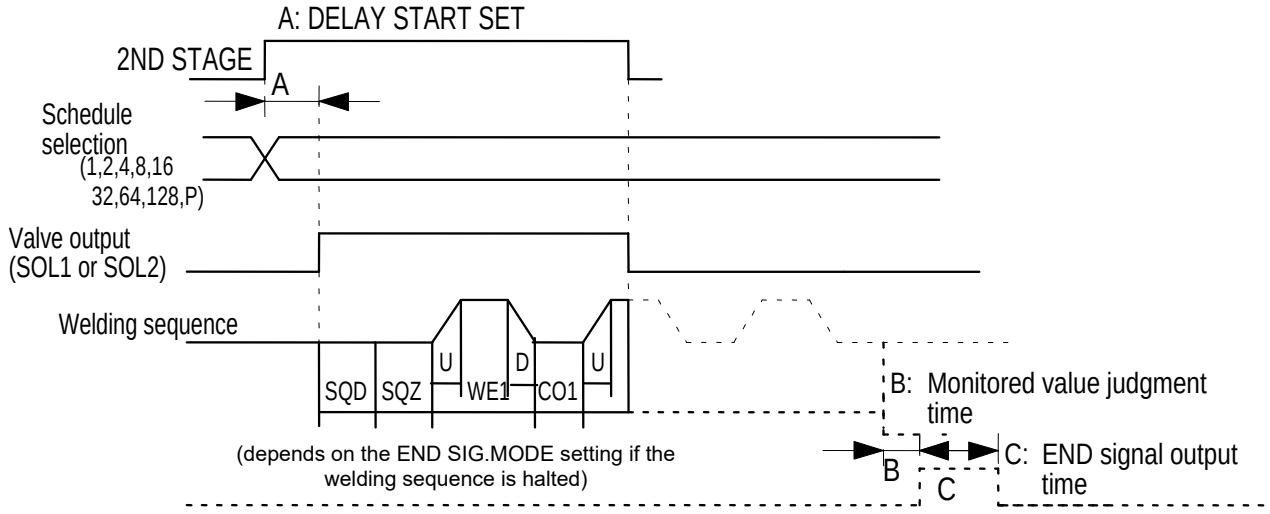
Start Signal Input

Weld sequence operation varies by the setting of **START SIG. MODE** on the Mode Select screen.

Maintained Mode

If the 2ND STAGE signal stops halfway through the welding sequence (from the beginning of initial squeeze delay time through the end of hold time), the welding sequence will halt at that point.

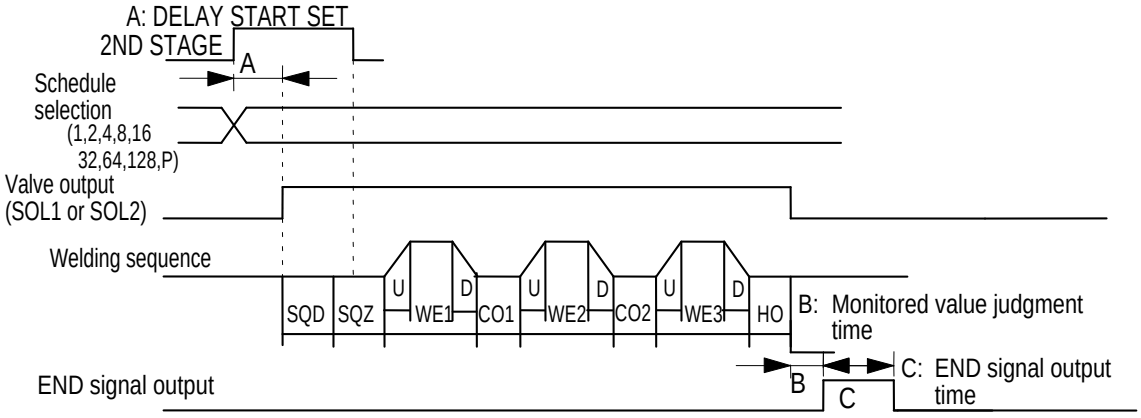
Note that the **END** signal depends on the **END SIG.MODE** setting.



Start Signal Input in Maintained Mode

Pulsed Mode

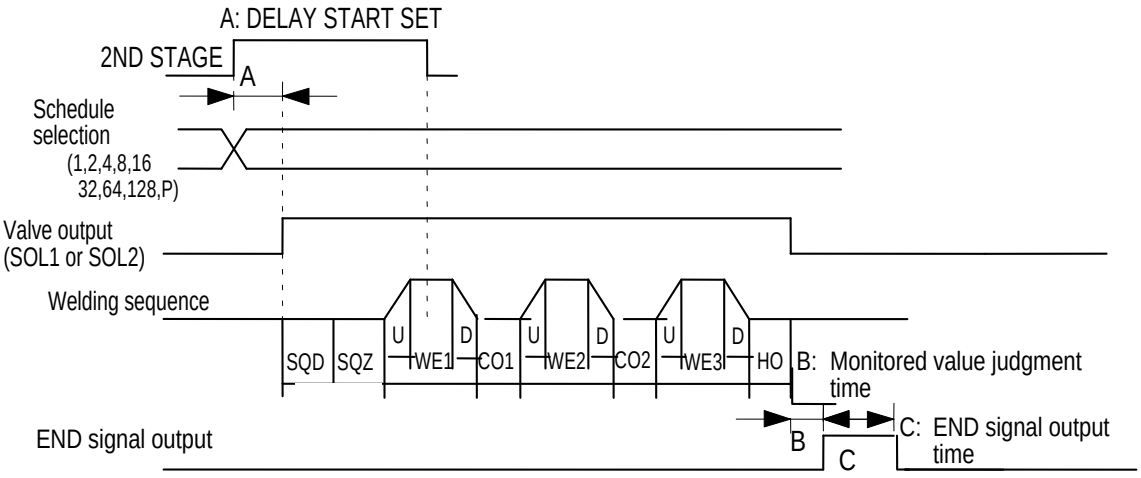
When the 2ND STAGE signal is input for more than the time set through DELAY START SET and then stops, the welding sequence will proceed to completion.



Start Signal Input in Pulsed Mode

Latched Mode

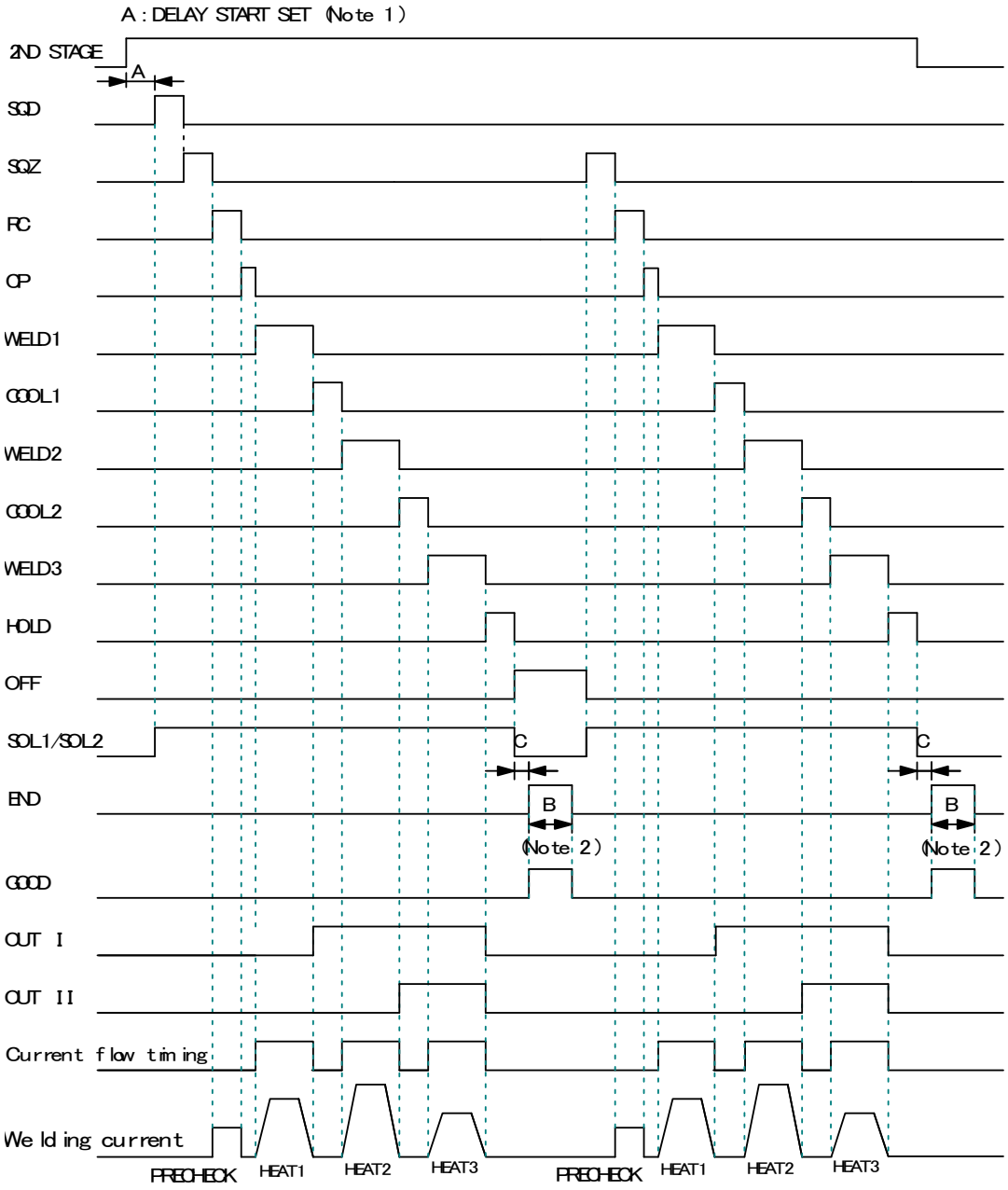
- The welding sequence halts if the 2ND STAGE signal stops during squeeze time (**SQZ**).
- The welding sequence proceeds to completion when the 2ND STAGE signal stops during Weld 1 time (**WE1**) or later.



Start Signal Input in Latched Mode

One-Stage Start

Stage 2 signal will begin the welding sequence with the selected Schedule #.



SQD: Squeeze delay time
SQZ: Squeeze time
RC: Resistance pre-check time
CP: Resistance judgment time (2ms)
WELD1: 1st weld time
COOL1: Cooling time 1
WELD2: 2nd weld time
COOL2: Cooling time 2
WELD3: 3rd weld time
HOLD: Hold time
OFF: Off time

A: DELAY START SET setting + Welding preparation time

The welding preparation time changes depending on the WELD TRANS FREQ (frequency) setting.

Frequency [Hz]	Welding preparation time [ms]	Frequency [Hz]	Welding preparation time [ms]
600	1.1	1000 to 1200	0.7
700	1.0	1300 to 1600	0.6
800	0.9	1700 to 2400	0.5
900	0.8	2500 to 3000	0.4

B: END SIG. TIME setting

The output time changes depending on the OFF time. See *Chapter 3: Using Programming Functions, Section 10: Mode Select Screen, Sub-section c: End Signal Mode*.

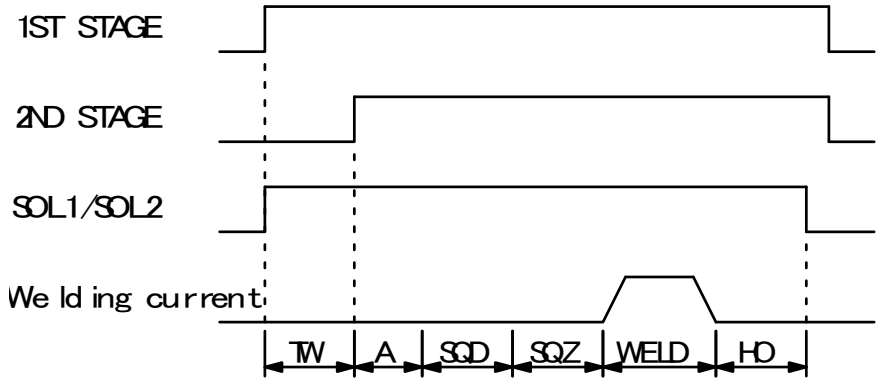
C: Monitored value judgment time 200 μs max.

(Note 1) To stop the sequence during **SQD** or **SQZ** (possible only when LATCHED or MAINTAINED is selected for **START SIG. MODE**; see *Chapter 3: Using Programming Functions, Section 10: Mode Select Screen, Sub-section b: Start Signal Mode*, stop the 2ND STAGE input for a period longer than that set for **DELAYSTART SET**.

(Note 2) When the current gets out of the range of upper/lower limit judgment (ERROR) in a sequence, repetition operation ends even if the OFF time is set.

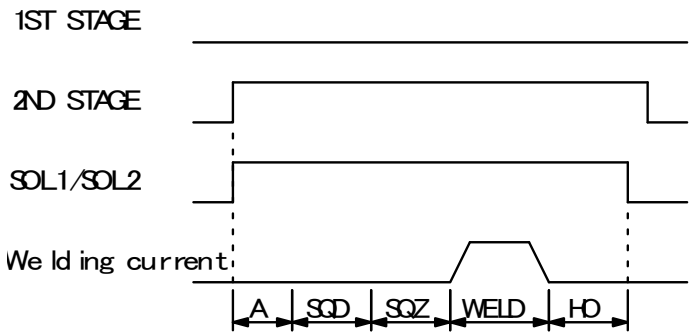
Two-Stage Start

When the 1ST STAGE is input, the solenoid valve output (SOL1 or SOL2) is turned ON and goes in to the standby state of the 2ND STAGE input. When the 2ND STAGE is input, welding sequence starts.



TW: 2ND STAGE input standby state.
A: DELAY START SET setting + Welding preparation time.

When the 2ND STAGE is input before the 1ST STAGE input, welding sequence starts. When welding sequence starts, 1ST STAGE signal is not received until welding sequence ends.

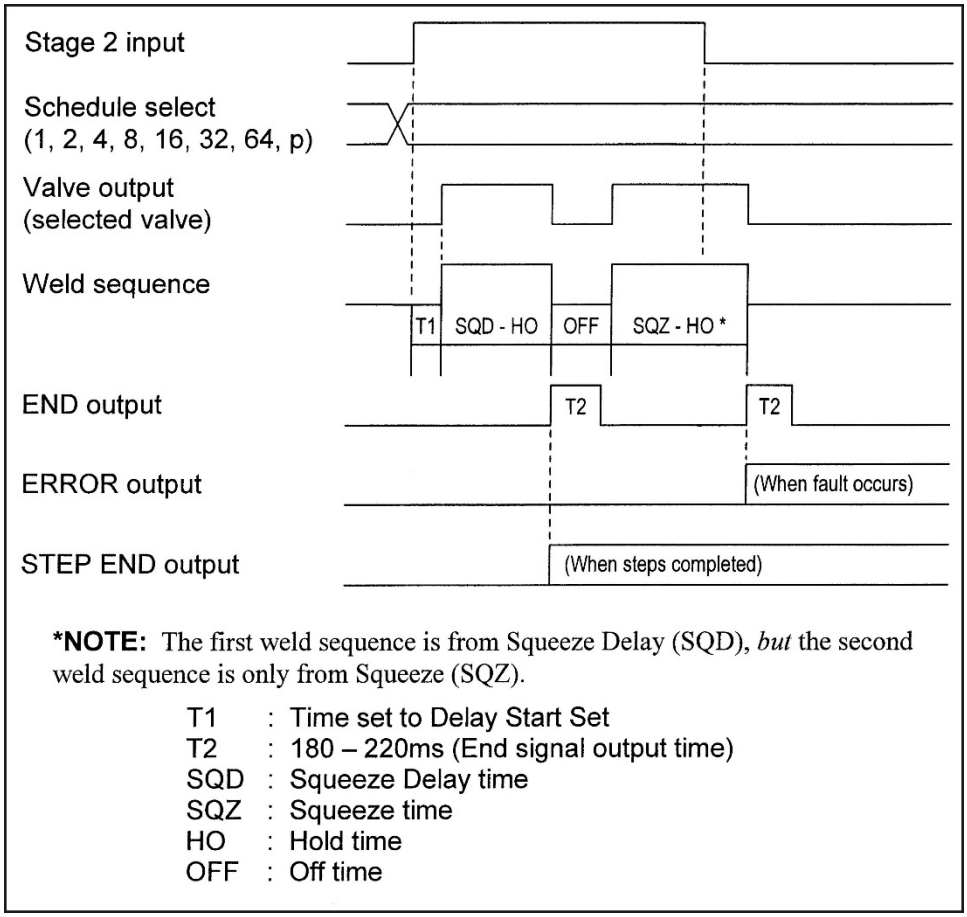


A: DELAY START SET setting + Welding preparation time.

Two-Stage Start

Repeat Operation

Repeat operation will occur whenever the Off time is set to any value other than zero (0).



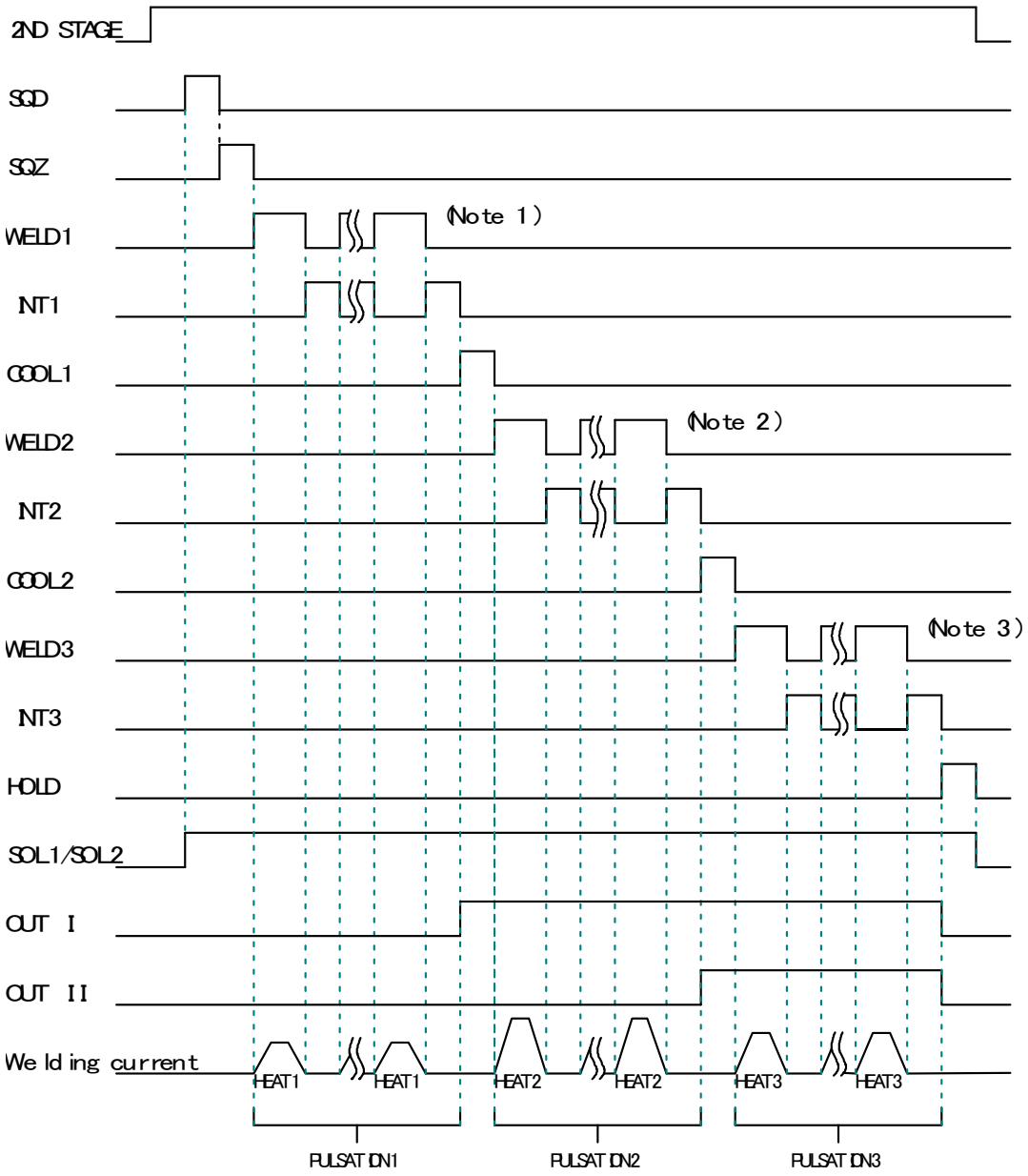
***NOTE:** The first weld sequence is from Squeeze Delay (SQD), *but* the second weld sequence is only from Squeeze (SQZ).

T1 : Time set to Delay Start Set
T2 : 180 – 220ms (End signal output time)
SQD : Squeeze Delay time
SQZ : Squeeze time
HO : Hold time
OFF : Off time

Repeat Operation

Pulsation

Operation is repeated in **WELD** and **INT** set times.



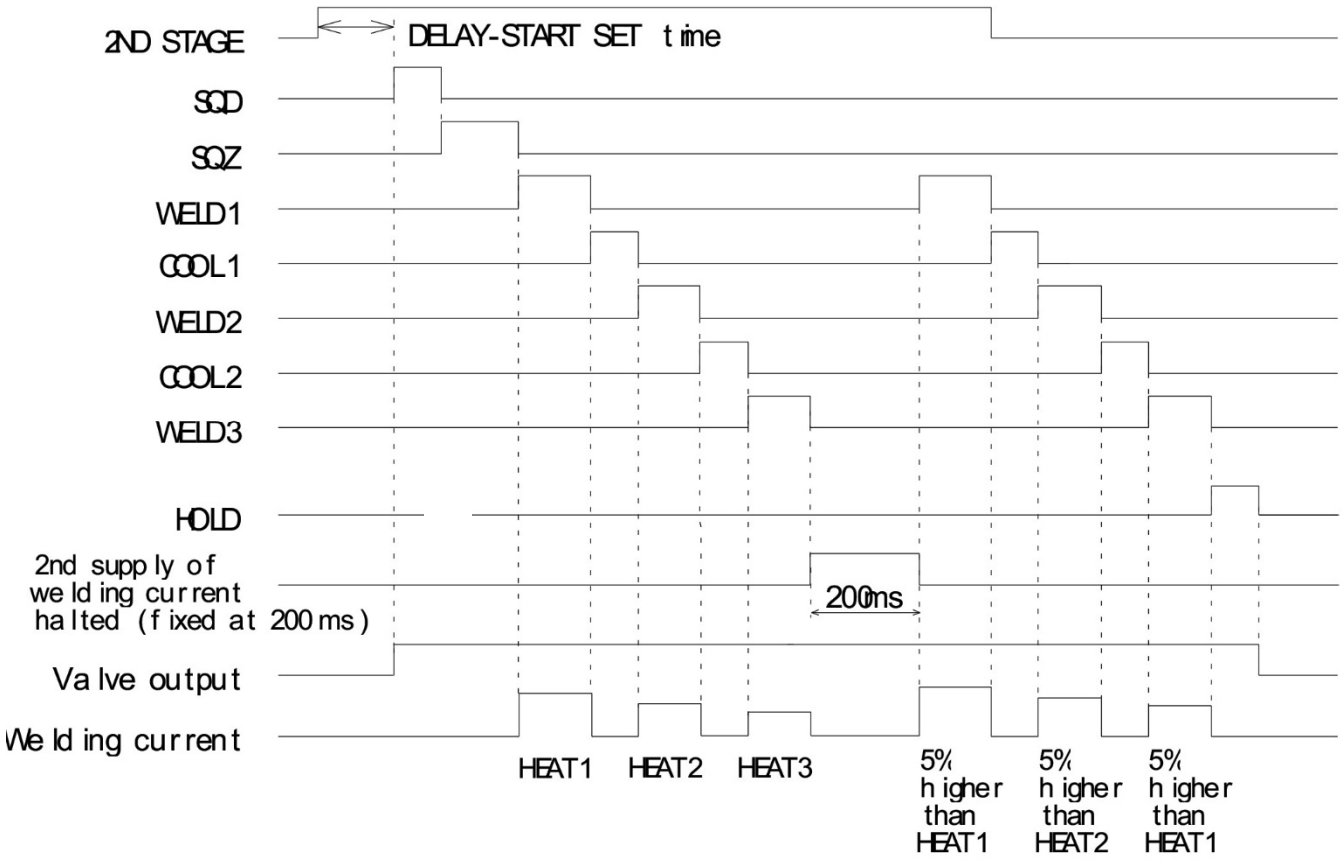
(Note 1) Repeat operation times set for PULSATION1 in WELD1 and INT1 set times. When PULSATION is set to 3, WELD to INT are repeated 3 times as follows; SQZ→ WELD1→ INT1→ WELD1→ INT1→ WELD1→ INT1→ WELD2...

(Note 2) Repeat operation times set for PULSATION2 in WELD2 and INT2 set times.

(Note 3) Repeat operation times set for PULSATION3 in WELD3 and INT3 set times.

Re-Weld

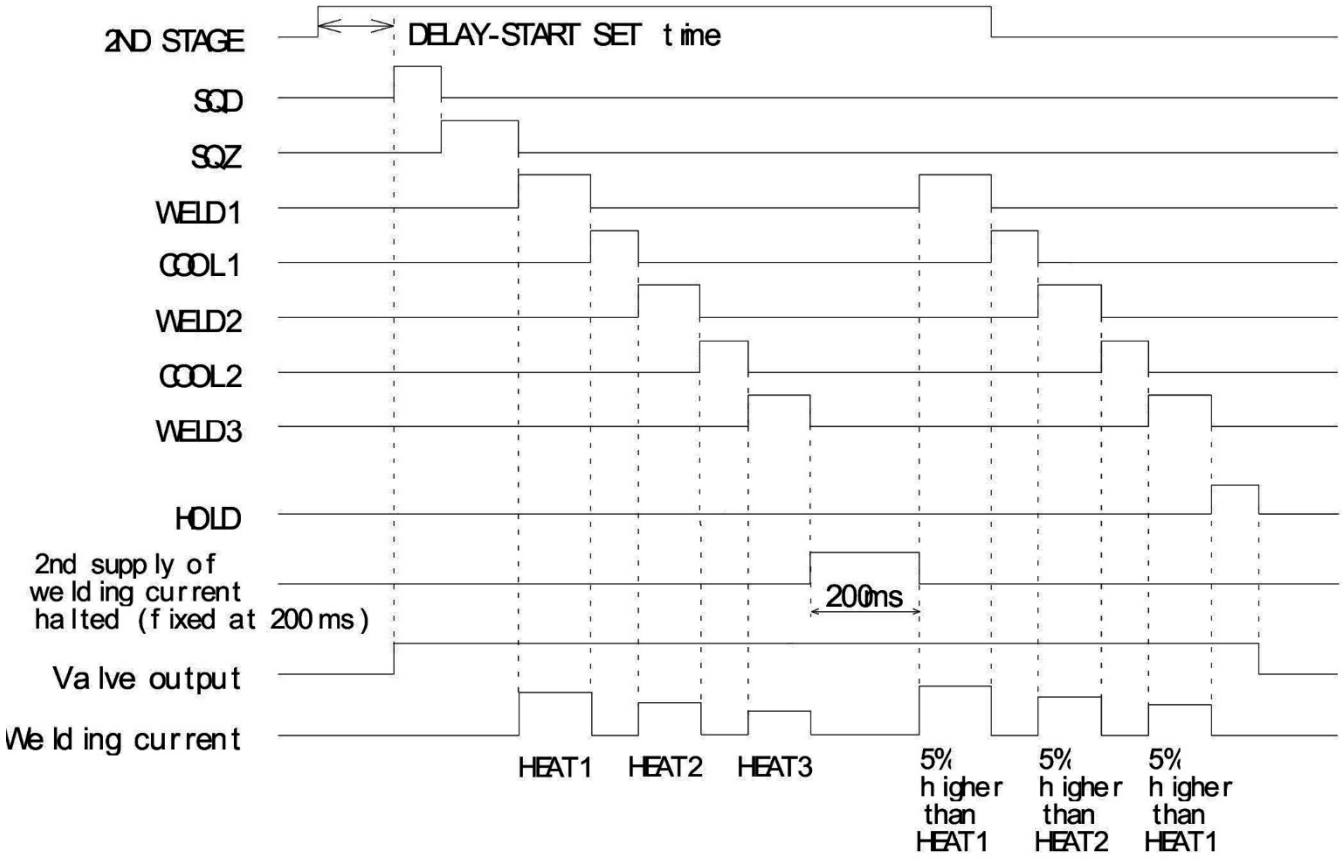
Re-weld will occur when Re-Weld is set On (Mode Select screen), and a current monitor error occurs as a low weld current shown below. Under that circumstance, a re-weld will occur with a 5% increase in weld current.



Re-Weld

Interrupt

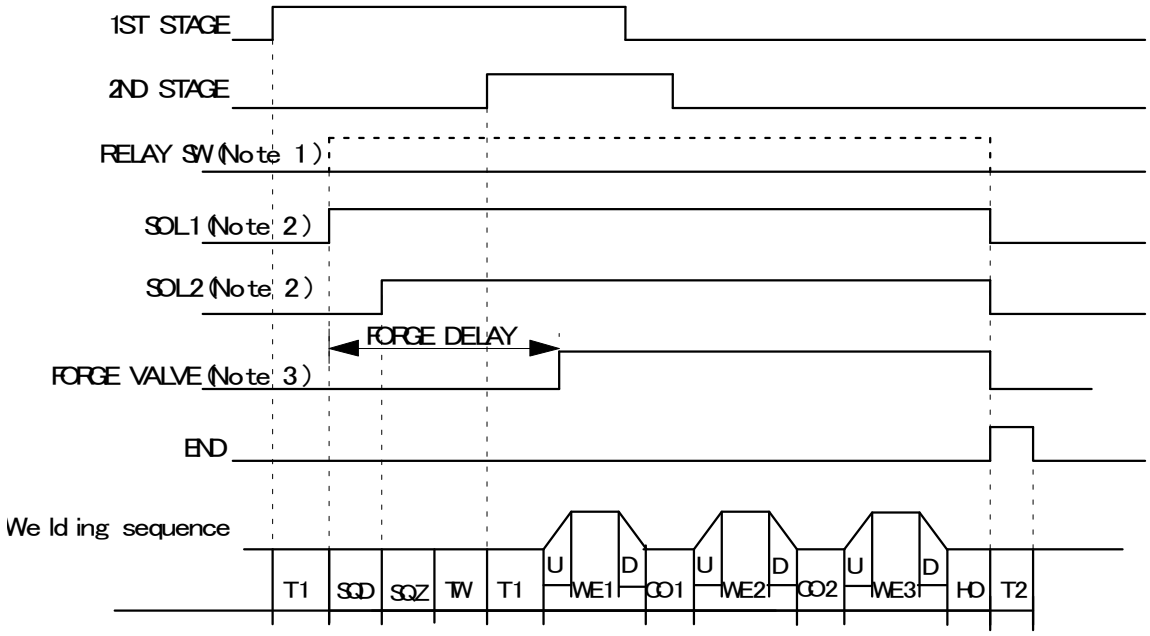
Interrupt will occur when Interrupt is set On (Mode Select screen), and an Interrupt signal is applied during a weld sequence. The weld cycle is immediately stopped and shifted to Hold (HO).



Interrupt

VALVE MODE- specific difference in sequence

When VALVE MODE is changed to “2 VALVE” from “1 VALVE”, two valve signals (SOL1 and SOL2) are output in a sequence. In this case, the settable VALVE No. is 1 or 2.



(Note 1) The RELAY SW signal is not output when VALVE# is set to “1”. It is output from SQD to HOLD only when VALVE# is set to “2”.

(Note 2) When VALVE# is set to “1”, the output signal No. of SOL1 is 36 and that of SOL2 is 37 on the 39-pin terminal strip. When VALVE# is set to “2”, the output signal No. of SOL1 is 2 (EX SOL1) and that of SOL2 is 3(EX SOL2) on the 25-pin D-Sub connector.

(Note 3) The output signal No. of FORGE VALVE is 4 (EX SOL3) when VALVE# is set to “1”, and 5 (EX SOL4) on the 25-pin D-Sub connector when VALVE# is set to “2”.

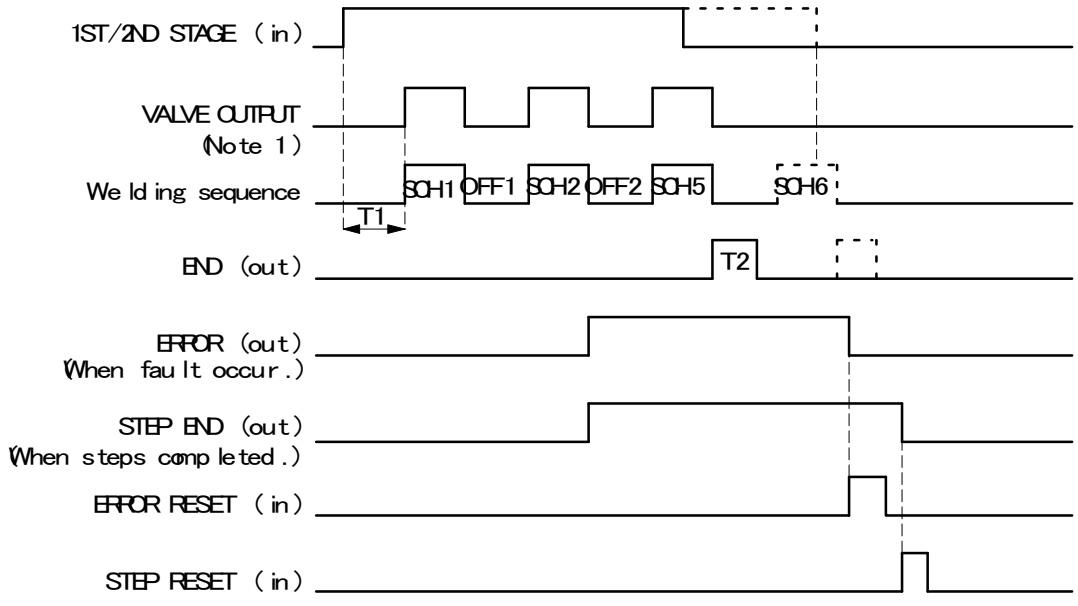
The timing charts below are for IS-800CA/1400CA Advanced ONLY

CHAINING Function

This function can call up welding multiple SCHEDULEs in order to perform them while the 1ST STAGE signal and the 2ND STAGE signal are input.
The SCHEDULE used in the chaining function is set in CHAINING on the FORCE SETUP & MONITOR screen. For details, see *Chapter 3: Using Programming Functions, Section 3: Force Setup & Monitor Screen*.
Even if start is maintained, the sequence executes the final SCHEDULE and ends.

[Example] At 1-stage start operation

(For 2-stage start, the start method is different, but the operation after start is the same.)
In this example, the CHAINING settings for SCHEDULE1, 2, 5, and 6 are ON, and those for other SCHEDULEs are OFF.
Since the 2ND STAGE signal is OFF when the sequence of SCHEDULE5 ends, SCHEDULE6 is not executed.
Next, when the 2ND STAGE signal is input, the sequence starts from the first SCHEDULE1.



T1 : Time set by [DELAY START SET]
T2 : Duration of END output signal
OFF1 : OFF time set by [SCHEDULE1]
OFF2 : OFF time set by [SCHEDULE2]

(Note 1) When the VALVE MODE setting is 1 VALVE, the valve selected from EXSOL1to4 is output.

Successive and Back Step Function

This function can switch welding multiple SCHEDULEs in order to perform them each time the 1ST STAGE signal and the 2ND STAGE signal are input.

The SCHEDULE used in the successive function is set in SUCCESSIVE on the FORCE SETUP & MONITOR screen. For details, see *Chapter 3: Using Programming Functions, Section III: Force Setup & Monitor Screen, sub-section m: Successive.*

When the back step signal is input, SCHEDULE returns to the previous one.

Also, when the back step signal is input over 1.5 seconds, SCHEDULE returns to the first one.

The END signal is output at the end of each SCHEDULE.

[Example] At 1-stage start operation

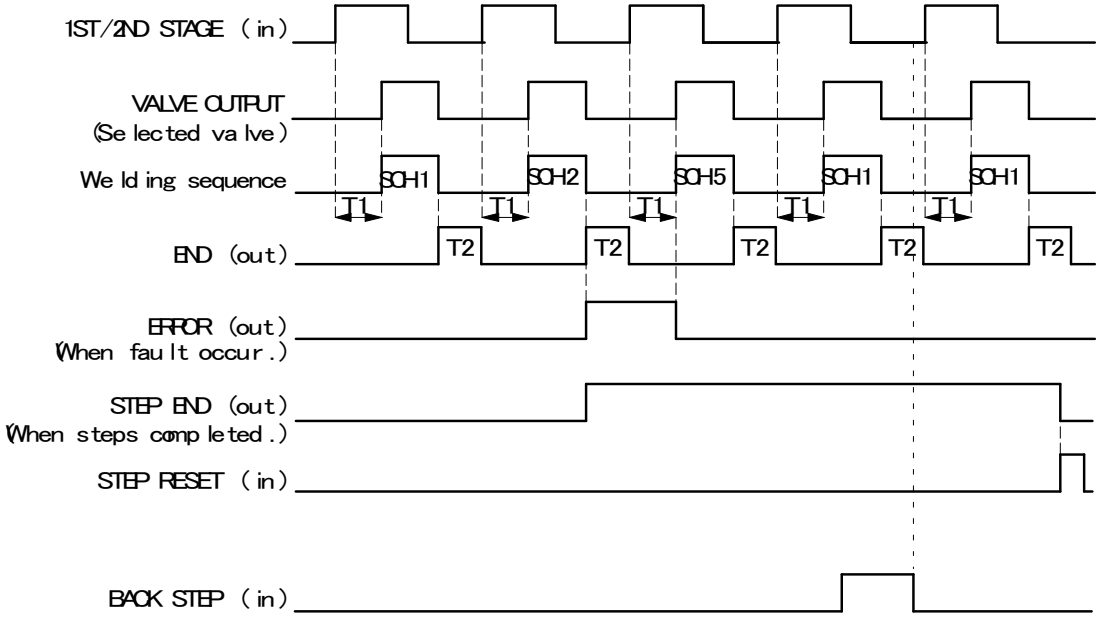
(For 2-stage start, the start method is different, but the operation after start is the same.)

In this example, the SUCCESSIVE settings for SCHEDULE1, 2 and 5 are ON, and those for other SCHEDULEs are OFF.

SCHEDULE1 comes after SCHEDULE5.

Next, when the 2ND STAGE signal is input, the sequence starts from the first SCHEDULE1.

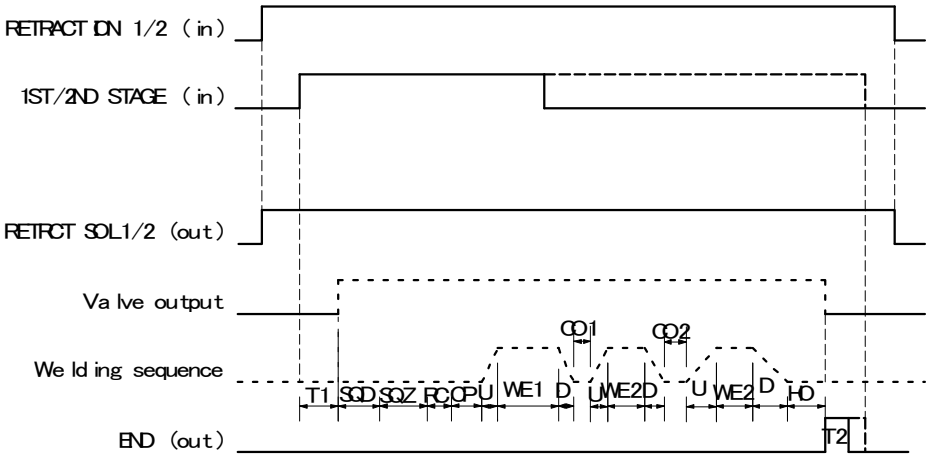
The sequence also starts from SCHEDULE1 once the power supply is turned off.



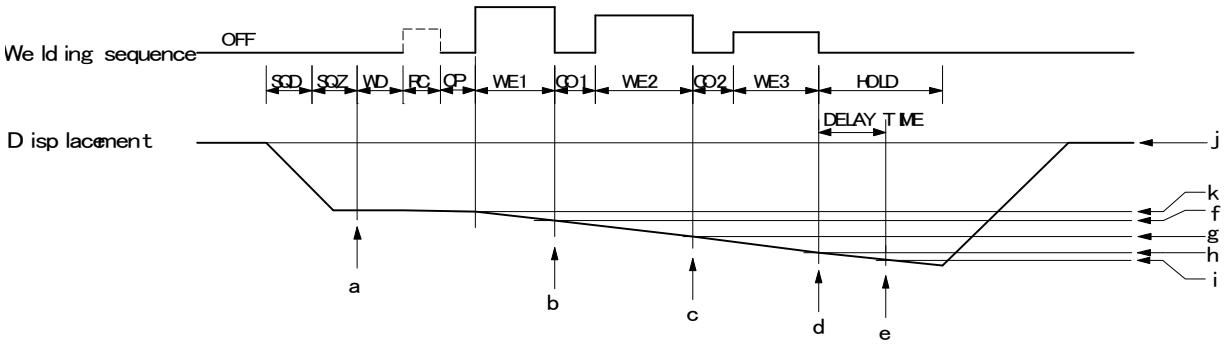
T1 : Time set by [DELAY START SET]
T2 : Duration of END output signal

Retraction Function

This function can output the retraction valve signal while the retraction signal is input. Since the electrode opening can be temporarily extended during welding, the direction of workpiece can be easily changed. However, the retraction valve signal cannot be turned ON/OFF during welding sequence.



T1 : Time set by [DELAY START SET]
T2 : Duration of END output signal



WD : Work detect time
RC : Resistance precheck time
CP : Resistance judgment time

a: Work detection — When the work detection is set on the DISPLACEMENT screen, the workpiece detection is done after the end of SQZ. When ± 00.00 mm is set, the work detection is not done.

b: Weld1 stop (WE1) — When the displacement weld stop (DISPLC) is set to the weld1 stop on the DISPLACEMENT screen and the displacement sensor arrives at the set displacement (f at the above figure), the weld1 stop is stopped to make the sequence move to the next cool time(CO1).

c: Weld2 stop (WE2) When the displacement weld stop (DISPLC) is set to the weld2 stop on the DISPLACEMENT screen and the displacement sensor arrives at the set displacement(g at the above figure), the weld2 stop is stopped to make the sequence move to the next cool time(CO2).

d: Weld3 stop (WE3) When the displacement weld stop (DISPLC) is set to the weld3 stop on the DISPLACEMENT screen and the displacement sensor arrives at the set displacement(h at the above figure), the weld3 stop is stopped to make the sequence move to HOLD.

e: Delay time When the delay time is set on the DISPLACEMENT screen, the displacement (i at the above figure)after the delay time elapses is measured.

(Notes)

- The displacement of work detection is set as 0mm (reference point) at “j” (right before SQD).
- “k” at the end of work detection is set as 0mm (reference point) of weld stop and the final displacement (0mm for work detection and 0mm for the final displacement monitor are different.)
- The displacement between “k” and “j” is the monitor displacement (WORK DETECT MONITOR) for work detection.
- The displacement between “j” and “i” is the monitored value of the final displacement (DISPLACEMENT MONITOR).

APPENDIX D
WIRE GAUGE SELECTION AND CIRCUIT BREAKER SETTING

Sizing Power Input Lines and Transformer Input Lines

Due to the many possible combinations of transformer ratios, total secondary resistance and weld voltages, all which have a direct relationship for cable sizing, this section assumes that the secondary current is at its maximum peak current during the weld.

Wire gauges for the AC Mains and Output lines to the transformer must meet the following criteria:

a. For the 480 VAC or 380 VAC 3 phase lines, the voltage drop must be less than 5%. Note also, that if the input source drops by 1% then the cable allowance is reduced to 4% maximum. A table is provided that gives the maximum length for the gauge selected (calculation is linear). Ampacity must be equal to, or larger than the effective current based on NEC table 310-16.

b. For the Output lines to the transformer it is recommended that voltage loss does not exceed 1%. A table is provided that gives the maximum length for the gauge selected (calculation is linear). Ampacity must be larger than the effective current based on NEC table 310-16.

In general:

Size all cables for the maximum secondary current anticipated for your installation. Preferred would be at full capability of 100 amps at 100% duty cycle.

Minimize cable length as much as possible.

If in doubt use a larger gauge cable.

Use the minimum number of connections as possible.

Insure that all connections are tight.

Formulas used:

I_{EFF} = Output current times the square root of the duty cycle.

I_{PH} = Resultant (I_{EFF} x 0.817) current in each phase of the 3-phase input source.

Example:

Using the table below:

- If a 200 amp output current at 100% duty cycle is required, the I_{EFF} is 200 amps.
- For the Transformer lines: use a 3/0 cable with a maximum length of 80 feet.
- For the AC lines: use 1/0 cable with a maximum length of 282 feet.

PRIMARY CURRENT VS WELD DUTY CYCLE				CABLE TO OUTPUT TRANSFORMER		CABLE TO UNIT (480 VAC INPUT)	
Output Current	**Weld Duty Cycle (%)**	**I_{EFF}**	**I_{PH}**	**AWG @ I_{EFF} Amps**	**1% Drop (feet)**	**AWG @ I_{PH}**	**5% Drop (feet)**
*500	15	194	158	3/0	80	1/0	282
*400	24	196	160	3/0	80	1/0	282
*280	50	198	162	3/0	80	1/0	282
*200	100	200	163	3/0	80	1/0	282
150	100	150	123	1	40	2	170
100	100	100	82	3	25	4	110
50	100	50	41	8	8	8	45

* Maximum output current at rated duty cycle.

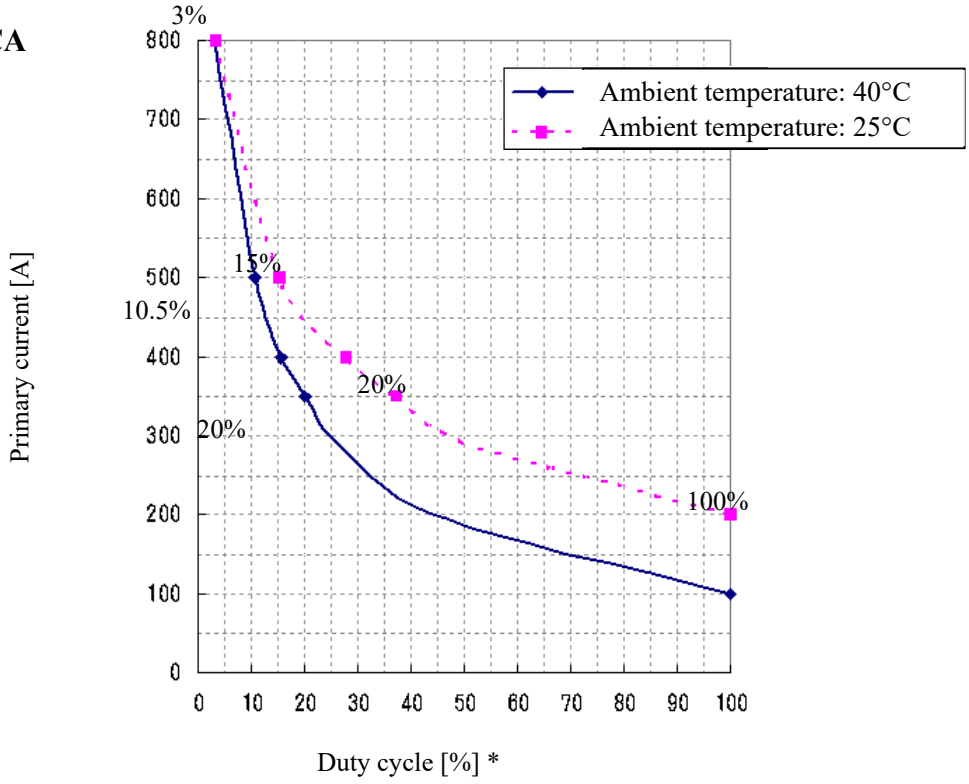
* Rated capacity at 25 °C.

NOTES:

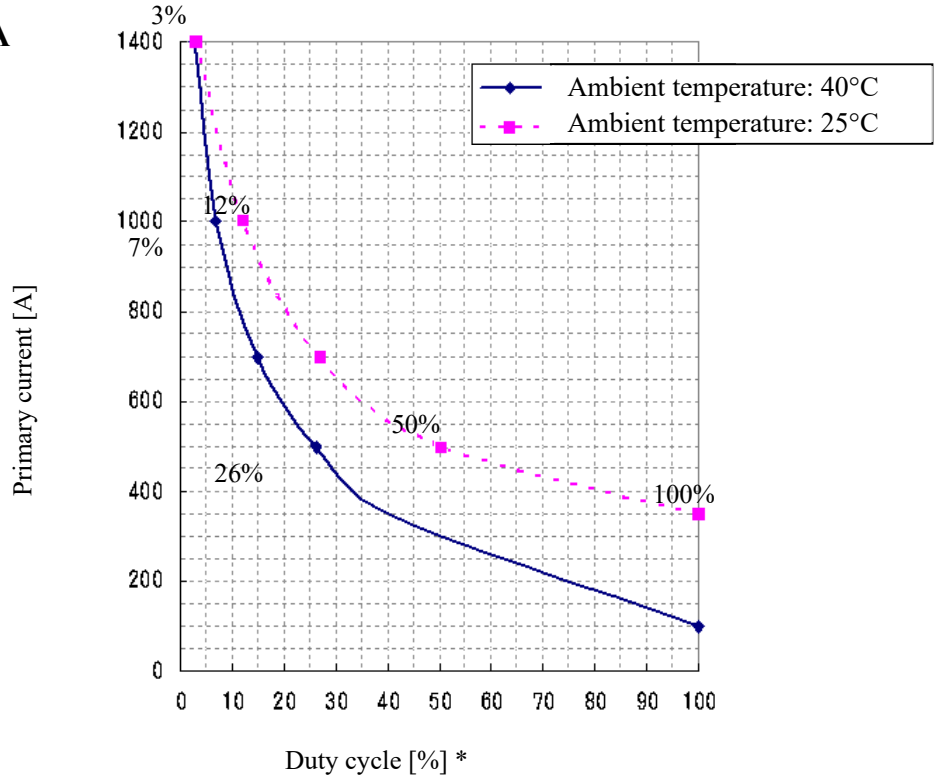
- For other output currents see the table on the next page.
- For other output currents at different duty cycles, apply the above formula to find the new I_{EFF}, the use the following table for cable sizes and maximum lengths.
- If I_{EFF} is not in the table, use the next higher current.

Duty Cycles

IS-800CA



IS-1400CA



CABLE TO OUTPUT TRANSFORMER		
I_{EFF}	AWG @ I_{EFF} amps	1% Drop (feet)
410	500 MCM	77
350	500 MCM	80
200	3/0	80
190	2/0	62
180	2/0	62
170	1/0	50
155	1/0	50
150	1	40
135	1	40
130	2	31
115	2	31
110	3	25
105 ⋮ 100	3 ⋮ 3	25 ⋮ 25
95	4	20
90	4	20
75	6	13
55	8	8

CABLE TO UNIT (480 VAC INPUT)		
I_{PH}	AWG @ I_{PH}	5% drop (feet)
335	300 MCM	380
286	300 MCM	449
163	1/0	282
155	1/0	282
147	1	211
139	1	211
127	2	170
123	2	170
110	3	135
106	3	135
94	4	110
90	4	110
86 ⋮ 82	4 ⋮ 4	110 ⋮ 110
78	4	110
74	6	70
61	6	70
45	8	45

Circuit Breaker Settings

The dipswitches referred to in his section are located on the ABB circuit breaker, ***not*** on the IS motherboard. The dipswitches are clearly labeled on the circuit breaker. Please refer to this manual if you need more information on the circuit breaker.

The circuit breaker has three adjustments:

ADJUSTMENT	TRIP FUNCTION	RANGE	INDIVIDUAL SETTINGS
L	Long time pick-up	0.4 - 1.0	0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 1.0 x I_n
t1	Long time delay	3.0 - 18 sec	A = 3, B = 6, C = 12, D = 18 seconds
I	Instantaneous trip	1.5 - 12.0	1.5, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0 x I_n

I_n = 250 Amps for IS-800CA

I_n = 400 Amps for IS-1400CA

*See circuit breaker front panel for dipswitch settings.

Setting L

Calculate the breaker rated current using the Effective secondary current and duty cycle of the weld schedule.

Circuit Breaker setting = Output Current X $\sqrt{DC/100}$ X 0.817

DC is the duty cycle of the weld schedule in percent.

Example: Output current is 500amps @ a duty cycle of 15%.
Breaker should be set at 114 amps or more.
Set the L dipswitch to 125 amps (0.5) or 150 amps (0.6).

Example: Output current is 350 amps @ a duty cycle of 20%.
Breaker should be set at 128 amps or more.
Set the L dipswitch to 150 amps (0.6) or 175 amps (0.7).

Setting t1 Set to 3 seconds (A). This setting should require no further adjustment.

Setting I Set to 4.0 as the maximum peak current is 1000 amps.

NOTE: If circuit breaker nuisance trips, set L higher or set I to 6.

APPENDIX E
OPTIONS

Overview

Chapters 1 through *5* and *Appendices A* through *D* of this manual describe the standard configuration of the Power Supply. You may also order Power Supplies with these Options:

- Isolation Contactors
- Larger Control Transformer
- 24 Volt DC Power Supply
- CE compliance
- Communications option that allows the Power Supply to be used with a host computer or with automation control systems. Detailed descriptions for this option are in *Appendix F, Communications. (In Section 1: Data Connections it refers to DB-9 connectors as if they were standard on every model. They only come with the Communications Option.*

Control Transformer

The control transformer provides 120 VAC to power the valves and to the 24 VDC Power Supply if installed (option). The standard Control Transformer is rated at 150 VA; an optional 250 VA transformer is available.

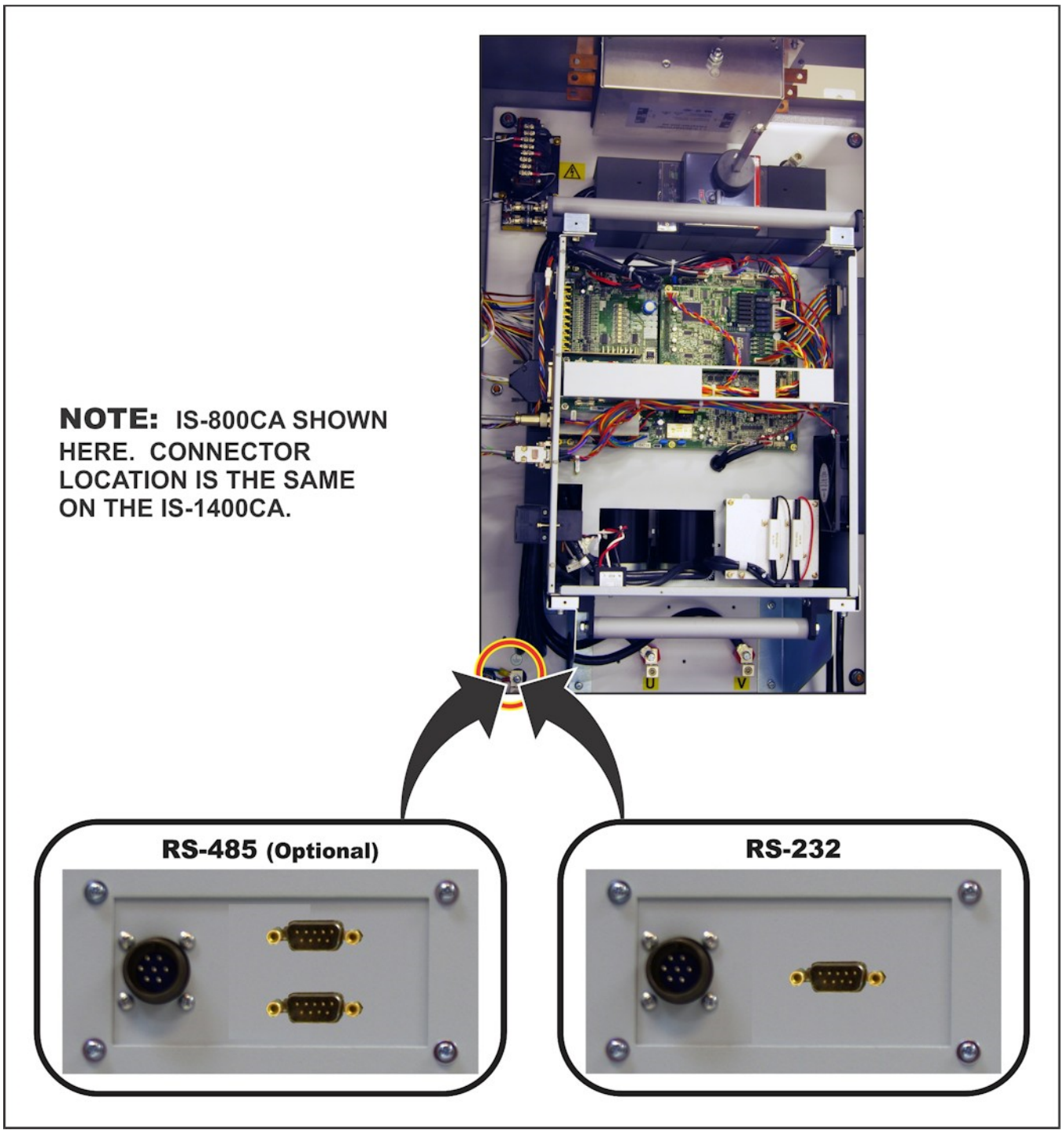
24 Volt DC Power Supply (Not Shown)

The 24 Volt DC Power Supply is only available as an option. When installed it provides 24 VDC to power the valves. Two options are available: 2.0 amps (50 watts) and 6.0 amps (150 watts). Note: There must be a Control Transformer (of the correct VA) installed to provide AC power to 24 Volt DC Power Supply.

Solid-State Relay

This solid-state-relay drives the isolation contactors. Only when TB1 pin 41 (Contactor) is at a **HIGH** (nominal 24 VDC) referenced to pin 0 will the contacts close. This can be accomplished either with switch, jumper, PLC, Transistor or FET that can source a positive 24 volts DC of least 20 mA. (Voltage source at TB1 pin 40 can be used)

External Communications Connectors



Isolation Contactors

CAUTION

- Do ***not*** **OPEN** or **CLOSE** the isolation contactors during any welding. The contacts are designed for dry switching only and may be damaged if switched when welding current is flowing.
- Do ***not*** use the isolation contactors as a substitute for an Emergency Stop Switch. The isolation contactors will ***only*** open the two output lines to the welding transformer.

This option adds two internal Normally Open (N/O) contactors to the Power Supply. One contactor is connected in series with the positive side terminal that connects to the external welding transformer the other contactor is connected in series with the negative terminal that connects to the external welding transformer. The isolation contactors provide a means to disconnect the Power Supply pulse DC (IGBTs) output to the welding transformer. The isolation contactors should never be operated during a weld process!

In addition to the N/O main contacts there are two Normally Closed (N/C) auxiliary contacts and two Normally Open (N/O) auxiliary contacts that are wired in series, respectively. These lines brought out to TB1 pins 42 (Contactor N/O), 43 (Contactor Com) and 44 (Contactor N/C) to be used by the user as sense lines to ensure that both contactors are Open or Closed depending on the input command at TB1 as shown in the table below.

CONTACTORS COMMAND PINS TB1 40, 41	MAIN CONTACTS (N/O) L1 L2 L3	AUXILIARY CONTACTS (N/O) PINS TB1 42, 43	AUXILIARY CONTACTS (N/C) PINS TB1 43, 44
OPEN	OPEN	OPEN	SHORTED
SHORTED	CLOSED	SHORTED	OPEN

After the command to close the contactors is given, allow not less than 40ms before applying weld current. This will provide sufficient time for the solid-state relay, coils, and contacts to settle before current is applied to the welding transformer.

CAUTIONS:

- Do ***not*** **OPEN** or **CLOSE** the isolation contactors during any welding. The contacts are designed for dry switching only and may be damaged if switched when welding current is flowing.
- Do ***not*** use the isolation contactors as a substitute for an Emergency Stop Switch. The isolation contactors will ***only*** open the two output lines to the welding transformer.

NOTES:

- If the weld command is given with the contactors are OPEN, no current will flow to the welding transformer. The Power Supply will give an error and stop all operations.
- The Power Supply does not have any automatic means to know if the contactors are installed. All commands and contact OPEN/CLOSURE sense lines states must be provided and detected by the user.

CE Compliance

The weld control can be purchased with special CE filter and shields to be CE compliant.

APPENDIX F
Communications

Section I. Description

Overview

The standard communication is RS-232C.

RS-485 is a hardware option (pendant needs to be set to RS-232C)

Remote Programming

Advanced users may wish to perform programming for custom welding applications. The codes needed to perform remote programming are listed in *Section II. Communications Protocol and Commands*. Using these codes, users can write customized software for controlling all functions of the welding control and interfacing the unit to automation control systems.

Section II. External Communication Function

Introduction

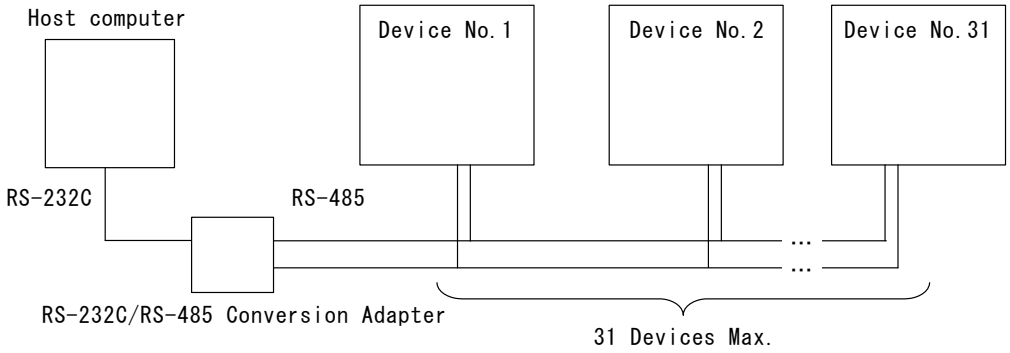
The **IS-800CA/1400CA** can be used to set schedules from an externally-connected personal computer (abbreviated as PC) or to read monitored data and several kind of status data.

Data Transmission

ITEM	CONTENT
Transmission Mode	Select only one mode at MODE SELECT screen: RS-232C (RS-485 requires factory installed RS-485 option)
Transmission Rate	Select either of the followings at MODE SELECT screen: 9,600, 19,200, 38,400 bps
Data Format	Start bit: 1, Data bit: 8, Stop bit: 1, Parity bit: Even
Character Code	ASCII
Checksum Data	None
Connector	D-Sub 9 pins Pin Position RS-232C, 2: RXD, 3: TXD, 5: SG, 7: RTS (RS-485 requires factory installed RS-485 option)

Configuration

① RS-485

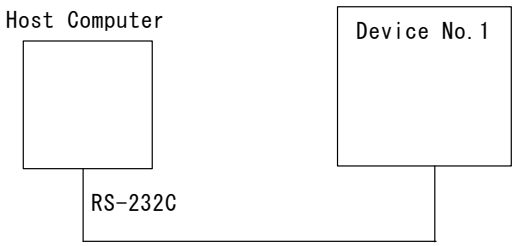


(Note 1) When controlling two or more devices with one host computer, register the device No. (**CONTROL#**) for each device. Set the device No. at **POWER SUPPLY STATE Screen,** See *Chapter 3: Using Programming Functions, Section II: Programming Options for **Basic** and **Advanced** Models, sub-section 2. Power Supply State Screen*.

(Note 2) Do not assign one number to more than one device. Also, do not send data simultaneously from two or more devices in the single-directional communication mode. Otherwise, data collision and inappropriate system operations may result.

(Note 3) The RS-232C/RS-485 conversion adapter is not included in the accessories. It is required to prepare the adapter at customer's side.

② RS-232C



Only a device can be connected.

Protocol

Single-directional Communication Mode
(When **-->** is selected at **COMM CONTROL** in **MODE SELECT Screen**)

1) Monitor Data

IS-800CA/1400CA **Basic** Data strings:

```
!01 001 :m, 120,1.20, 0.50, 00.60,20.0, 200,2.00, 1.50, 03.00,40.0,300, 2.50,
 A   B C    D   E     F     G     H    I    J    K     L     M    N    O
```
Continued on next line

```
2.00, 05.00,50.0,2, 0010,5,0100, 2222,555555[CR][LF]
 P     Q     R S   T   U V    W     X
```

IS-800CA/1400CA **Advanced** Data strings:

```
!01 001 :m, 120,01.20,0.50, 00.60,20.0, 200,02.00,1.50, 03.00,40.0,300, 02.50,
 A   B C    D   E     F     G     H    I    J    K     L     M    N    O
```
Continued on next line

```
2.00, 05.00,50.0,2, 0010,5,0100, 1, 0000,1,0000, 01, 100,0100,2222,555555,
 P     Q     R S   T   U V    W  X    Y Z    AA  AB  AC   AD     AE
```
Continued on next line

```
05000, 05000, 05000, 05000, 05000, 05000, +00.100, +01.120, [CR][LF]
 AF     AG     AH     AI     AJ     AK      AL       AM
```

A	Device No.	Fixed to 2 digits (01 to 31)
B	Schedule No.	Fixed to 3 digits (001 to 255)
C	Unit of monitor time	m: ms C: CYC
D	Monitor time of WE1	Fixed to 3 digits (000 to 999) (ms) Fixed to 3 digits (000 to 050) (CYC)
E	Monitor current of WE1	Fixed to 4 digits (0.00 to 9.99) (kA) Fixed to 4 digits (00.0 to 99.9) (kA)
F	Monitor voltage of WE1	Fixed to 4 digits (0.00 to 9.99) (V)
G	Monitor power of WE1	Fixed to 5 digits (00.00 to 09.99) (kW) Fixed to 5 digits (000.0 to 999.9) (kW)
H	Monitor pulse width of WE1	Fixed to 4 digits (10.0 to 99.9) (%)
I	Monitor time of WE2	Fixed to 3 digits (000 to 999) (ms) Fixed to 3 digits (000 to 050) (CYC)
J	Monitor current of WE2	Fixed to 4 digits (0.00 to 9.99) (kA) Fixed to 4 digits (00.0 to 99.9) (kA)
K	Monitor voltage of WE2	Fixed to 4 digits (0.00 to 9.99) (V)
L	Monitor power of WE2	Fixed to 5 digits (00.00 to 09.99) (kW) Fixed to 5 digits (000.0 to 999.9) (kW)
M	Monitor pulse width of WE2	Fixed to 4 digits (10.0 to 99.9) (%)

N	Monitor time of WE3	Fixed to 3 digits (000 to 999) (ms) Fixed to 3 digits (000 to 050) (CYC)
O	Monitor current of WE3	Fixed to 4 digits (0.00 to 9.99) (kA) Fixed to 4 digits (00.0 to 99.9) (kA)
P	Monitor voltage of WE3	Fixed to 4 digits (0.00 to 9.99) (V)
Q	Monitor power of WE3	Fixed to 5 digits (00.00 to 09.99) (kW) Fixed to 5 digits (000.0 to 999.9) (kW)
R	Monitor pulse width of WE3	Fixed to 4 digits (10.0 to 99.9) (%)
S	STEP No. of VALVE1	Fixed to 1 digit (1 to 9)
T	STEP COUNT of VALVE1	Fixed to 4 digits (0000 to 9999)
U	STEP No. of VALVE2	Fixed to 1 digit (1 to 9)
V	STEP COUNT of VALVE2	Fixed to 4 digits (0000 to 9999)
W	COUNTER (WELD/WELD COUNT of WORK)	Fixed to 4 digits (0000 to 9999)
X	COUNTER (WORK of TOTAL/GOOD/WORK)	Fixed to 6 digits (000000 to 999999)
The following additional commands are for IS-800CA/1400CA **Advanced** ONLY		
Y	STEP No. of VALVE4	Fixed to 1 digit (1 to 9)
Z	STEP COUNT of VALVE4	Fixed to 4 digits (0000 to 9999)
AA	STEP2 REPEAT	Fixed to 2 digits (01 to 99)
AB	STEP RATIO	Fixed to 3 digits (050 to 200)
AC	CAP CHANGE	Fixed to 4 digits (0000 to 9999)
AD	COUNTER (WELD/WELD COUNT of WORK)	Fixed to 4 digits (0000 to 9999)
AE	COUNTER (WORK of TOTAL/GOOD/WORK)	Fixed to 6 digits (000000 to 999999)
AF	FORCE of SQD	Fixed to 5 digits (00000 to 35000 (N), 00000 to 03569 (kgf), and 00000 to 07868 (lbf))
AG	FORCE of SQZ	
AH	FORCE of WELD1	
AI	FORCE of COOL1/WELD1	
AJ	FORCE of COOL2/WELD3	
AK	FORCE of HOLD	
AL	WORK DETECT	Fixed to 7 digits (-99.999 to +99.999 mm)
AM	DISPLACEMENT	

2) Error Data

IS-800CA/1400CA **Basic** Data strings:

!01 000:E03,04,12,15,17,[CR][LF]
A B C D E F G

A	Device No.	Fixed to 2 digits (01 to 31)
B	Schedule No.	Fixed to 3 digits (001 to 255)
C*1	Error Code 1	Fixed to 3 digits (E01 to E31)
D*1	Error Code 2	Fixed to 2 digits (01 to 31)
E*1	Error Code 3	Fixed to 2 digits (01 to 31)
F*1	Error Code 4	Fixed to 2 digits (01 to 31)
G*1	Error Code 5	Fixed to 2 digits (01 to 31)

IS-800CA/1400CA **Advanced** Data strings:

!01 000:E03,04,12,15,17,19, 22, 26[CR][LF]
A B C D E F G H I J

A	Device No.	Fixed to 2 digits (01 to 31)
B	Schedule No.	Fixed to 3 digits (001 to 255)
C*1	Error code 1	Fixed to 3 digits (E01 to E39)
D*1	Error code 2	Fixed to 2 digits (01 to 39)
E*1	Error code 3	Fixed to 2 digits (01 to 39)
F*1	Error code 4	Fixed to 2 digits (01 to 39)
G*1	Error code 5	Fixed to 2 digits (01 to 39)
H*1	Error code 6	Fixed to 2 digits (01 to 39)
I*1	Error code 7	Fixed to 2 digits (01 to 39)
J*1	Error code 8	Fixed to 2 digits (01 to 39)

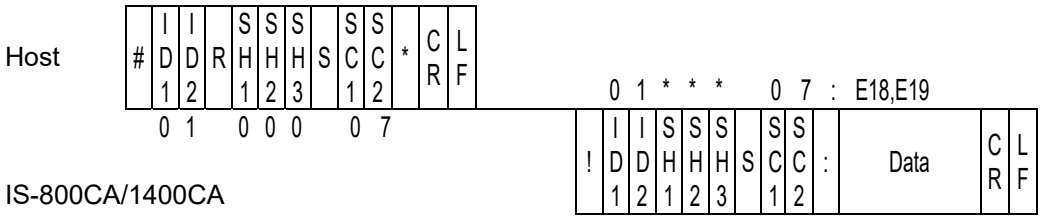
*1 The number of Error Codes is of five max. for IS-800CA/1400CA **Basic**, max. 8 for **Advanced**. In the case of only one error code, the error codes D to G (**Basic**) and D to J (**Advanced**) are omitted.
For Error Codes, see *Chapter 5: Maintenance, Section I: Troubleshooting*.

*2 Error codes are transmitted when errors are detected.
For the monitored value error and counter error, however, the error is transmitted after the monitored data is transmitted.

3) Bi-directional Communication Mode
(When **<-->** is selected at **COMM CONTROL** in **MODE SELECT Screen**)

Reading of Trouble	Code: # Device No. R Schedule No. Screen No. *

Example: Read all troubled data in the specified device, No. 01. (Schedule No. is "008" and Voltage error and Electric power error are occurring.)



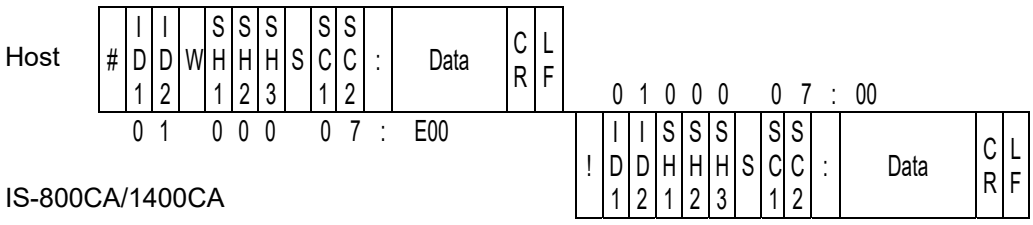
1) Schedule numbers, SH1, SH2 and SH3 are fixed to 000.
However, schedule numbers are sent from **IS-800CA/1400CA** when "E06: Current error", "E18: Voltage error", "E19: Electric power error" and "E07: Pulse width error" occurs.

2) Screen numbers, SC1 and SC2 are fixed to 07.

3) If there is no error, data of "00" returned.

Error Reset	Code: # Device No. W Schedule No. Screen No. Data

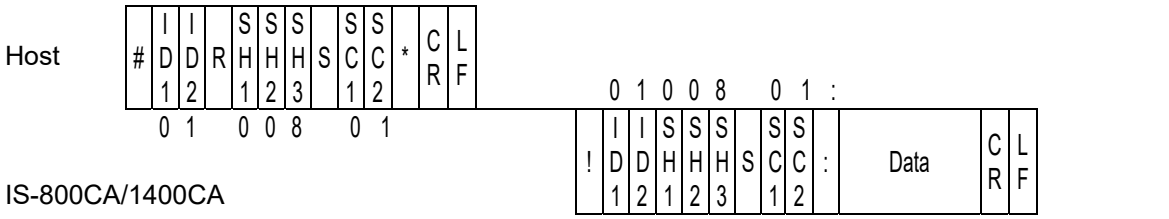
Example: Resets the trouble of the specified device, No. 01.



1) Schedule Nos, SH1, SH2 and SH3 are fixed to 000.
2) Screen Nos, SC1 and SC2 are fixed to 07.
3) "00" (no trouble) is returned as a confirmation data

Reading of Data	Code: # Device No. Screen No. R Schedule No. *

Example: Read all data of Screen No. "01" of Schedule No. "008" of the specified device No. 01.



Insert [,] between data for a schedule.

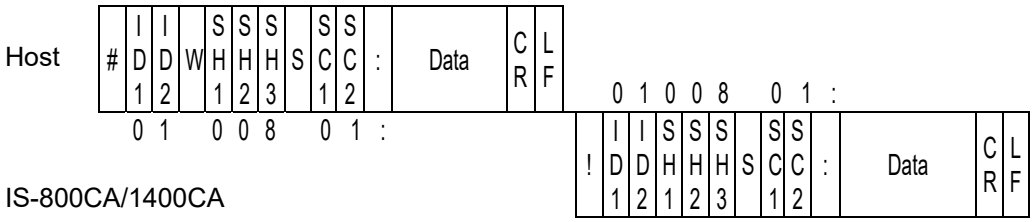
1) SH1, SH2 and SH3 are schedule numbers.
   Fixed to 3 digits (SH1=Hundred's place, SH2=Ten's place, SH3=One's place)
   However, screen 03, 05 and 07 are fixed to the schedule No. 000.

2) SC1 and SC2 are screen numbers.
   Fixed to 2 digits (SC1=Ten's place, SC2=One's place)

3) For the data order for a schedule of each screen No., see the **Data Code List** below.

Setting of Data	Code: # Device No. W Schedule No. Screen No. Data

Example: Write data for a schedule of Screen No "01" of Schedule No. "008" of the specified device No. 01.



Insert [,] between data for a schedule.

1) SH1, SH2 and SH3 are schedule numbers.
   Fixed to 3 digits (SH1=Hundred's place, SH2=Ten's place, SH3=One's place)
   However, screen 03, 05 and 07 are fixed to 000 of schedule No.

2) SC1 and SC2 are screen numbers.
   Fixed to 2 digits (SC1=Ten's place, SC2=One's place)
   (Note) Screen 04 and 07 (1) are read only and cannot be written.

3) For the data order for a schedule and the screen No., see the **Data Code List** below.

4) The set data is returned as a confirmation data. When data which is outside the range is set, previous data is returned.

5) It takes about 1 second at most to save data into the internal memory (READY is turned off during saving). Be careful when writing continuously.

Data Code Table

Screen 01 (SCHEDULE data) Specific data in accordance with Schedule No. (001 to 255)

Example of data writing (Advanced unit):
#01W001S01:0,0,0,m,0000,0000,000,000,000,0000,000,000,000,0000,000,000,000,00000,0000,1,00.50,0
0.50,00.50,00.50,00.50,00.50,00.50,00.50,00.50,01,000,01,000,01,000,1000,01,1,001.0,0,000,99.9,99.9,9
9.9,010,1[CR][LF]

Item	Contents	Character String	Range
1	Control mode of WELD1	n,	0 to 5 0: Primary constant-current effective value control 1: Secondary constant-current effective value control 2: Secondary constant-power effective value control 3: Primary constant-current peak value control 4: Secondary constant-voltage effective value control 5: Constant-phase control
2	Control mode of WELD2	n,	
3	Control mode of WELD3	n,	
4	Unit of time *1	n,	m: ms C: CYC
5	SQD / Squeeze delay time	nnnn,	0000 to 9999 (ms mode) 0000 to 0999 (CYC mode)
6	SQZ/ Squeeze time	nnnn,	0000 to 9999 (ms mode) 0000 to 0999 (CYC mode)
7	UP1 / Upslope 1 time	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
8	WELD1 / Weld 1 time	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
9	DOWN1 / Downslope 1 time	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
10	COOL1 / Cooling 1 time	nnnn,	0000 to 9999(ms mode) 0000 to 0999(CYC mode)
11	UP2 / Upslope 2 time	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
12	WELD2 / Weld 2 time	nnn,	000 to 999(ms mode) 000 to 050 (CYC mode)
13	DOWN2 / Downslope 2 time	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
14	COOL2 / Cooling 2 time	nnnn,	0000 to 9999 (ms mode) 0000 to 0999 (CYC mode)
15	UP3 / Upslope 3 time	nnn,	000 to 999(ms mode) 000 to 050 (CYC mode)
16	WELD3 / Weld 3 time	nnn,	000 to 999(ms mode) 000 to 050 (CYC mode)
17	DOWN3 / Downslope 3 time	nnn,	000 to 999(ms mode) 000 to 050 (CYC mode)
18	HOLD / Hold time	nnnnn,	00000 to 20000 (ms mode) 00000 to 00999 (CYC mode)
19	OFF / Off time	nnnn,	0000 to 9990 (ms mode) 0000 to 0099 (CYC mode)

Item	Contents	Character String	Range
20	CURR RANGE / Current range	n,	0: 051: 102: 203: 40 4: 80 (kA)
21	UF1 / Initial heat 1 of upslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
22	HEAT1 / Heat 1	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
23	DL1 / End heat 1 of downslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
24	UF2 / Initial heat 2 of upslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
25	HEAT2 / Heat 2	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
26	DL2 / End heat 2 of downslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)

Item	Contents	Character String	Range
27	UF3 / Initial heat 3 of upslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
28	HEAT3 / Heat 3	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
29	DL3 / End heat 3 of downslope	nnn.n,	004.0 to 120.0 (kW)*2
		nn.n,	04.0 to 80.0 (kA)*2 02.0 to 40.0 (kA) 04.0 to 60.0 (kW) 01.0 to 20.0 (kA, kW) 10.0 to 99.9 (%)
		n.nn,	0.50 to 9.99 / 0.05 to 5.00 (kA, kW) 0.20 to 9.99 (V)
30	PULSATION of WE1 / WE1 repetition	nn,	00 to 19
31	INT1 / Interval 1	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
32	PULSATION of WE2 / WE2 repetition	nn,	00 to 19
33	INT2 / Interval 2	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
34	PULSATION of WE3 / WE3 repetition	nn,	00 to 19
35	INT3 / Interval 3	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
36	WELD TRANS FREQ / Welding transformer frequency	nnnn,	0600 to 3000 (Hz) Note) The last 2 digits are fixed to 00.
37	GAIN	nn,	1 to 9
38	VALVE	n,	1 to 2
39	TURN RATIO	nnn.n,	001.0 to 199.9
40	WELD ON/OF	n,	0: OFF 1: ON
41	VOLT COMP	nnn,	Fixed to 3 digits (000 to 100) (%)
42	PULSE LIM of WE1	nn.n,	Fixed to 4 digits (10.0 to 99.9) (%)
43	PULSE LIM of WE2	nn.n,	Fixed to 4 digits (10.0 to 99.9) (%)
44	PULSE LIM of WE3	nn.n	Fixed to 4 digits (10.0 to 99.9) (%)

Item	Contents	Character String	Range
	The following is additional data for IS-800CA/1400CA **Advanced**		
45	MAX CURRENT	nnn,	005 to 80 (kA)
46	TRANS#	n	1

*1 The setting of ms/CYC cannot be changed. You can change it via Screen 05 (SYSTEM data).
*2 **IS-1400A** only
*3 Screen 02 (MONITOR SET data) Specific data in accordance with Schedule No. (001 to 255)

Example of data writing (Basic and Advanced):
#01W001S02:999,000,99.99,00.00,9.99,0.00,99.99,00.00,100.0,999,000,99.99,00.00,9.99,0.00,99.99,00.00,100.0,999,000,99.99,00.00,9.99,0.00,99.99,00.00,100.0[CR][LF]

Item	Contents	Character String	Range
1	TIME H of WE1 (upper limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
2	TIME L of WE1 (lower limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
3	CURRENT H of WE1 (upper limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
4	CURRENT L of WE1 (lower limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
5	VOLT H of WE1 (upper limit)	n.nn,	0.00 to 9.99 (V)
6	VOLT L of WE1 (lower limit)	n.nn,	0.00 to 9.99 (V)
7	POWER H of WE1 (upper limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
8	POWER L of WE1 (lower limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
9	PULSE H of WE1 (upper limit)	nnn.n,	010 to 100 (%)
10	TIME H of WE2 (upper limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
11	TIME L of WE2 (lower limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
12	CURRENT H of WE2 (upper limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
13	CURRENT L of WE2 (lower limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
14	VOLT H of WE2 (upper limit)	n.nn,	0.00 to 9.99 (V)
15	VOLT L of WE2 (lower limit)	n.nn,	0.00 to 9.99 (V)
16	POWER H of WE2 (upper limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)

Item	Contents	Character String	Range
17	POWER L of WE2 (lower limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
18	PULSE H of WE2 (upper limit)	nnn.n,	010 to 100 (%)
19	TIME H of WE3 (upper limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
20	TIME L of WE3 (lower limit)	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
21	CURRENT H of WE3 (upper limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
22	CURRENT L of WE3 (lower limit)	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
23	VOLT H of WE3 (upper limit)	n.nn,	0.00 to 9.99 (V)
24	VOLT L of WE3 (lower limit)	n.nn,	0.00 to 9.99 (V)
25	POWER H of WE3 (upper limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
26	POWER L of WE3 (lower limit)	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
27	PULSE H of WE3 (upper limit)	nnn.n	010 to 100 (%)

IS-800CA/1400CA Basic: Screen 03 (STEPPER data) Common data (Schedule No.: 000)

Item	Contents	Character String	Range
1	START ON STEP # of VALVE1	n,	1 to 9
2	STEP1 COUNT of VALVE1	nnnn,	0000 to 9999
3	STEP2 COUNT of VALVE1	nnnn,	0000 to 9999
4	STEP2 RATIO of VALVE1	nnn,	050 to 200 (%)
5	STEP3 COUNT of VALVE1	nnnn,	0000 to 9999
6	STEP3 RATIO of VALVE1	nnn,	050 to 200 (%)
7	STEP4 COUNT of VALVE1	nnnn,	0000 to 9999
8	STEP4 RATIO of VALVE1	nnn,	050 to 200 (%)
9	STEP5 COUNT of VALVE1	nnnn,	0000 to 9999
10	STEP5 RATIO of VALVE1	nnn,	050 to 200 (%)
11	STEP6 COUNT of VALVE1	nnnn,	0000 to 9999
12	STEP6 RATIO of VALVE1	nnn,	050 to 200 (%)
13	STEP7 COUNT of VALVE1	nnnn,	0000 to 9999
14	STEP7 RATIO of VALVE1	nnn,	050 to 200 (%)
15	STEP8 COUNT of VALVE1	nnnn,	0000 to 9999
16	STEP8 RATIO of VALVE1	nnn,	050 to 200 (%)
17	STEP9 COUNT of VALVE1	nnnn,	0000 to 9999
18	STEP9 RATIO of VALVE1	nnn,	050 to 200 (%)
19	START ON STEP # of VALVE2	n,	1 to 9
20	STEP1 COUNT of VALVE2	nnnn,	0000 to 9999
21	STEP2 COUNT of VALVE2	nnnn,	0000 to 9999
22	STEP2 RATIO of VALVE2	nnn,	050 to 200 (%)
23	STEP3 COUNT of VALVE2	nnnn,	0000 to 9999
24	STEP3 RATIO of VALVE2	nnn,	050 to 200 (%)
25	STEP4 COUNT of VALVE2	nnnn,	0000 to 9999
26	STEP4 RATIO of VALVE2	nnn,	050 to 200 (%)
27	STEP5 COUNT of VALVE2	nnnn,	0000 to 9999
28	STEP5 RATIO of VALVE2	nnn,	050 to 200 (%)
29	STEP6 COUNT of VALVE2	nnnn,	0000 to 9999
30	STEP6 RATIO of VALVE2	nnn,	050 to 200 (%)
31	STEP7 COUNT of VALVE2	nnnn,	0000 to 9999
32	STEP7 RATIO of VALVE2	nnn,	050 to 200 (%)
33	STEP8 COUNT of VALVE2	nnnn,	0000 to 9999
34	STEP8 RATIO of VALVE2	nnn,	050 to 200 (%)
35	STEP9 COUNT of VALVE2	nnnn,	0000 to 9999
36	STEP9 RATIO of VALVE2	nnn	050 to 200 (%)

IS-800CA/1400CA Advanced: Screen 03 (STEPPER data) Common data (Valve No.: 001 to 004)

Example of data writing:
#01W001S03:1,0000,0,0000,100,0,0000,100,0,0000,100,0,0000,100,0,0000,100,0,0000,100,0,0000,100,0,0000,100,0,01,0000[CR][LF]

Item	Contents	Character String	Range
1	START ON STEP #	n,	1 to 9
2	COUNT of STEP1	nnnn,	0000 to 9999
3	TIP DRESS of STEP1	n,	0:OFF 1:ON(X)
4	COUNT of STEP2	nnnn,	0000 to 9999
5	RATIO of STEP2	nnn,	050 to 200(%)
6	TIP DRESS of STEP2	n,	0:OFF 1:ON(X)
7	COUNT of STEP3	nnnn,	0000 to 9999
8	RATIO of STEP3	nnn,	050 to 200(%)
9	TIP DRESS of STEP3	n,	0:OFF 1:ON(X)
10	COUNT of STEP4	nnnn,	0000 to 9999
11	RATIO of STEP4	nnn,	050 to 200(%)
12	TIP DRESS of STEP4	n,	0:OFF 1:ON(X)
13	COUNT of STEP5	nnnn,	0000 to 9999
14	RATIO of STEP5	nnn,	050 to 200(%)
15	TIP DRESS of STEP5	n,	0:OFF 1:ON(X)
16	COUNT of STEP6	nnnn,	0000 to 9999
17	RATIO of STEP6	nnn,	050 to 200(%)
18	TIP DRESS of STEP6	n,	0:OFF 1:ON(X)
19	COUNT of STEP7	nnnn,	0000 to 9999
20	RATIO of STEP7	nnn,	050 to 200(%)
21	TIP DRESS of STEP7	n,	0:OFF 1:ON(X)
22	COUNT of STEP8	nnnn,	0000 to 9999
23	RATIO of STEP8	nnn,	050 to 200(%)
24	TIP DRESS of STEP8	n,	0:OFF 1:ON(X)
25	COUNT of STEP9	nnnn,	0000 to 9999
26	RATIO of STEP9	nnn,	050 to 200(%)
27	TIP DRESS of STEP9	n,	0:OFF 1:ON(X)
28	STEP2 REPEAT	nn,	01 to 99
29	CAP CHANGE	nnnn	0000 to 9999

IS-800CA/1400CA Basic: Screen 04 (MONITOR data) (Data reading only) Specific data in accordance with Schedule No. (Schedule No.: 001 to 255)

Item	Contents	Character String	Range
1	Unit of time	n,	m: ms C: CYC
2	TIME of WELD1	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
3	CURRENT of WELD1	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
4	VOLT of WELD1	n.nn,	0.00 to 9.99 (V)
5	POWER of WELD1	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
6	PULSE of WELD1	nn.n,	00.0 to 99.9 (%)
7	TIME of WELD2	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
8	CURRENT of WELD2	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
9	VOLT of WELD2	n.nn,	0.00 to 9.99 (V)
10	POWER of WELD2	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
11	PULSE of WELD2	nn.n,	00.0 to 99.9 (%)
12	TIME of WELD3	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
13	CURRENT of WELD3	n.nn,	0.00 to 9.99 (kA)
		nn.n,	00.0 to 99.9 (kA)
14	VOLT of WELD3	n.nn,	0.00 to 9.99 (V)
15	POWER of WELD3	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
16	PULSE of WELD3	nn.n,	00.0 to 99.9 (%)
17	STEP # of VALVE1	n,	1 to 9
18	STEPPER COUNT of VALVE1	nnnn,	0000 to 9999
19	STEP # of VALVE2	n,	1 to 9
20	STEPPER COUNT of VALVE2	nnnn,	0000 to 9999
21	COUNTER (WELD/WELD COUNT of WORK)	nnnn,	0000 to 9999
22	COUNTER (WORK of TOTAL/GOOD/WORK)	nnnnnn	000000 to 999999

IS-800CA/1400CA Advanced: Screen 04 (MONITOR data) (Data reading only) Specific data in accordance with Schedule No. (Schedule No.: 001 to 255)

Item	Contents	Character String	Range
1	Unit of time	n,	m: ms C: CYC
2	TIME of WELD1	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
3	CURRENT of WELD1	nn.nn,	00.00 to 9.999 (kA)
		nnn.n,	000.0 to 999.9 (kA)
4	VOLT of WELD1	n.nn,	0.00 to 9.99 (V)
5	POWER of WELD1	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
6	PULSE of WELD1	nn.n,	00.0 to 99.9 (%)
7	TIME of WELD2	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
8	CURRENT of WELD2	nn.nn,	00.00 to 9.999 (kA)
		nnn.n,	000.0 to 999.9 (kA)
9	VOLT of WELD2	n.nn,	0.00 to 9.99 (V)
10	POWER of WELD2	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
11	PULSE of WELD2	nn.n,	00.0 to 99.9 (%)
12	TIME of WELD3	nnn,	000 to 999 (ms mode) 000 to 050 (CYC mode)
13	CURRENT of WELD3	nn.nn,	00.00 to 9.999 (kA)
		nnn.n,	000.0 to 999.9 (kA)
14	VOLT of WELD3	n.nn,	0.00 to 9.99 (V)
15	POWER of WELD3	nn.nn,	00.00 to 99.99 (kW)
		nnn.n,	000.0 to 999.9 (kW)
16	PULSE of WELD3	nn.n,	00.0 to 99.9 (%)
17	STEP # of VALVE1	n,	1 to 9
18	STEPPER COUNT of VALVE1	nnnn,	0000 to 9999
19	STEP # of VALVE2	n,	1 to 9
20	STEPPER COUNT of VALVE2	nnnn,	0000 to 9999
21	STEP # of VALVE3	n,	1 to 9
22	STEPPER COUNT of VALVE3	nnnn,	0000 to 9999
23	STEP # of VALVE4	n,	1 to 9
24	STEPPER COUNT of VALVE4	nnnn,	0000 to 9999
25	STEP2 REPAT	nn,	01 to 99
26	STEP RATIO	nnn,	050 to 200(%)
27	CAP CHANGE	nnnn,	0000 to 9999
28	COUNTER (WELD/WELD COUNT of WORK)	nnnn,	0000 to 9999
29	COUNTER (WORK of TOTAL/GOOD/WORK)	nnnnnn	000000 to 999999
30	SQD FORCE	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
31	SQZ FORCE	nnnnn,	
32	WE1 FORCE	nnnnn,	
33	COOL1/WELD1 FORCE	nnnnn,	
34	COOL2/WELD3 FORCE	nnnnn,	
35	HOLD FORCE	nnnnn,	

Item	Contents	Character String	Range
36	WORK DETECT	+nn.nnn, -nn.nnn,	-99.999 to +99.999(mm)
37	DISPLACEMENT	+nn.nnn, -nn.nnn,	

Screen 05 (PRE-CHECK data) Specific data in accordance with Schedule No. (001 to 255)

Item	Contents	Character String	Range
1	PRECHECK TIME	nnn,	000 to 100 (ms)
2	PRECHECK HEAT	nn.n,	10.0 to 99.9 (%)
3	PRECHECK RESISTANCE HIGH	nn.nn,	00.00 to 99.99 (mΩ)
4	PRECHECK RESISTANCE LOW	nn.nn,	00.00 to 99.99 (mΩ)
5*[1]	PRECHECK MONITOR	nn.nn	00.00 to 99.99 (mΩ)

*1 Items inhibited from setting (When setting data, omit these items.)

IS-800CA/1400CA Basic: Screen 06 (SYSTEM data) Common data (Schedule No.: 000)

Item	Contents	Character String	Range
1*[1]	POWER SOURCE FREQUENCY	nn,	50 or 60 (Hz)
2*[1]	Model name	nnnnnnnn,	ISB-800A or ISB1400A (IS-800CA/1400CA is NEMA style version of ISB-800A/1400A)
3*[1]	ROM VERSION	Vnn-nnn,	V00-00A ~
4	DELAY START SET	nn,	01 to 20 (ms)
5	START SIGNAL MODE	n,	0: LATCHED 1: PULSED 2: MAINTAINED
6	END SIGNAL TIME	nnn,	000, 010 to 200 (ms)
7	END SIGNAL MODE	n,	0, 1, 2
8	WELD1 STOP/PARITY CHECK	n,	0: WELD1 STOP 1: PARITY CHECK
9	WELD2 STOP/WELD COUNT	n,	0: WELD2 STOP 1: WELD COUNT
10	WELD3 STOP/COUNT RESET	n,	0: WELD3 STOP 1: COUNT RESET
11	WELD TIME	n,	0: ms 1: CYC
12	RE-WELD	n,	0: OFF 1: ON
13	SCHEDULE	n,	0: EXT 1: INT
14	STEPPER MODE	n,	0: OFF 1: FIXED 2: LINER
15	COUNTER	n,	0: TOTAL 1: GOOD 2: WORK
16	COMM CONTROL	n,	0: OFF 1: --->2: <--->

Item	Contents	Character String	Range
17	COMM SPEED	n,	0: 9.6k 1: 19.2k 2: 38.4k
18	COMM MODE	n,	0: RS-485 1: RS-232C
19	MONI DISP MODE	n,	0: NORMAL 1: LAST
20	PRESET COUNT	n,	0: TOTAL/GOOD 1: WELD/WORK
21	TOTAL/GOOD of PRESET COUNT	nnnnnn,	000000 to 999999
22	WELD of WELD/WORK, PRESET COUNT	nnnn,	0000 to 9999
23	WORK of WELD/WORK, PRESET COUNT	nnnnnn,	000000 to 999999
24	NO CURRENT TIME	nn,	01 to 99 (ms)
25	NO CURRENT LEVEL	n.nn,	0.00 to 9.99 (kA)
26	NO VOLTAGE LEVEL	n.nn,	0.00 to 9.99 (V)
27	MONITOR FIRST TIME	nn,	00 to 15 (ms)
28	MONITOR SLOPE MODE	n,	0: EXCLUDE 1: INCLUDE
29	WELD STOP OFF TIME of WELD1	nnn,	000 to 999 (ms)
30	WELD STOP OFF TIME of WELD2	nnn,	000 to 999 (ms)
31	WELD STOP OFF TIME of WELD3	nnn,	000 to 999 (ms)
32	OUTPUT MODE of NG SIGNAL SELECT	n,	0: N.C. 1: N.O.
33	TIME-OVER of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
34	CURR-OVER of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
35	VOLT-OVER of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
36	POWER-OVER of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
37	PULSE-OVER of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
38	NO CURR of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
39	WRK ERR of NG SIGNAL SELECT	n,	0: ERROR 1: CAUTION
40*[1]	PROGRAM PROTECT	n	0: OFF 1: ON

*1 Items inhibited from setting (When setting data, omit these items.)
"," is not transmitted, too. In other words, the 4th item (DELAY START SET) will be the first data.

IS-800CA/1400CA Advanced: Screen 06 (SYSTEM data) Common data (Schedule No.: 000)

Example of data writing:
#01W000S06:20,0,200,0,0,0,0,0,0,0,0,0,0,000000,0000,000000,0000,50,0.00,0.00,15,0,000,000,
000,0,1,1,1,1,1,0,0,0,1,2014,02,27,0,0,0,0,1,2,3,4,1.0[CR][LF]

Item	Contents	Character String	Range
1*1	POWER SOURCE FREQUENCY	nn,	50 or 60 (Hz)
2*1	Model name	nnnnnnnn,	ISB-800A or ISB1400A
3*1	ROM VERSION	Vnn-nnn,	V00-00A to
4	DELAY START SET	nn,	01 to 20 (ms)
5	START SIGNAL MODE	n,	0: LATCHED 1: PULSED 2: MAINTAINED
6	END SIGNAL TIME	nnn,	000, 010 to 200 (ms)
7	END SIGNAL MODE	n,	0, 1, 2
8	WELD1 STOP/PARITY CHECK	n,	0:WELD1 STOP 1:PARITY CHECK
9	WELD2 STOP/WELD COUNT	n,	0:WELD2 STOP 1:WELD COUNT
10	WELD3 STOP/COUNT RESET	n,	0:WELD3 STOP 1:COUNT RESET
11	WELD TIME	n,	0: ms 1: CYC
12	RE-WELD	n,	0: OFF 1: ON
13	SCHEDULE	n,	0:EXT 1:INT
14	STEPPER MODE	n,	0:OFF 1:FIXED 2:LINER
15	COUNTER	n,	0:TOTAL 1:GOOD 2:WORK
16	COMM CONTROL	n,	0:OFF 1:--->2:<--->
17	COMM SPEED	n,	0:9.6k 1:19.2k 2:38.4k
18	COMM MODE	n,	0:RS-485 1:RS-232C
19	MONI DISP MODE	n,	0:NORMAL 1:LAST
20	PRESET COUNT	n,	0:TOTAL/GOOD 1:WELD/WORK
21	TOTAL/GOOD of PRESET COUNT	nnnnnn,	000000 to 999999
22	WELD of WELD/WORK, PRESET COUNT	nnnn,	0000 to 9999
23	WORK of WELD/WORK, PRESET COUNT	nnnnnn,	000000 to 999999
24	NO CURRENT TIME	nn,	01 to 99 (ms)
25	NO CURRENT LEVEL	n.nn,	0.00 to 9.99 (kA)
26	NO VOLTAGE LEVEL	n.nn,	0.00 to 9.99 (V)
27	MONITOR FIRST TIME	nn,	00 to 15 (ms)
28	MONITOR SLOPE MODE	n,	0: EXCLUDE1: INCLUDE
29	WELD STOP OFF TIME of WELD1	nnn,	000 to 999(ms)
30	WELD STOP OFF TIME of WELD2	nnn,	000 to 999(ms)

Item	Contents	Character String	Range
31	WELD STOP OFF TIME of WELD3	nnn,	000 to 999(ms)
32	OUTPUT MODE of NG SIGNAL SELECT	n,	0:N.C. 1:N.O.
33	TIME-OVER of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
34	CURR-OVER of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
35	VOLT-OVERof NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
36	POWER-OVER of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
37	PULSE-OVER of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
38	NO CURR of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
39	WRK ERR of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
40	WORK OVER of NG SIGNAL SELECT	N,	0:ERROR 1:CAUTION
41	DISPLOVER of NG SIGNAL SELECT	n,	0:ERROR 1:CAUTION
42*1	PROGRAM PROTECT	n	0:OFF1:ON
43*1	CONTRAST	n,	0 to 9
44*1	CONTROL#	nn,	01 to 31
45	PROGRAMD DATE YEAR	nnnn,	2000 to 2099
46	PROGRAMD DATE MONTH	nn,	01 to 12
47	PROGRAMD DATE DAY	nn,	01 to 31
48	LANGUAGE	n,	0:ENGLISH 1:JAPANESE
49	FLOW SWITCH/PRG PROTECT	n,	0:FLOW SWITCH 1:PRG PROTECT
50	VALVEMODE	n,	0:1 VALVE 1:2 VALVE
51	SCANMODE	n,	0:OFF
52	OUTPUT1	n,	0:END 1:COUNTERROR 2:READY 3:STEPEND 4:WELDSIGNAL 5:GOOD 6:COUNTUP 7:OUTI 8:OUTII
53	OUTPUT2	n,	
54	OUTPUT3	n,	
55	OUTPUT4	n,	
56	OUTPUT5	n,	
57	DISPL SENSOR STEP	n.n	0.5 to 5.0(um)

*1 Items inhibited from setting (When setting data, omit these items.)
“,” is not transmitted, too.

IS-800CA/1400CA Basic: Screen 07 (Error data) Common data (Schedule No.: 000)

- Error data confirmation (Data reading only)

Item	Contents	Character String	Range
1	Error code 1	nnn,	E01 to E32
2	Error code 2	nn,	01 to 32
3	Error code 3	nn,	01 to 32
4	Error code 4	nn,	01 to 32
5	Error code 5	nn	01 to 32

The number of Error Codes is of five max. In the case of only one error code, the items 2 to 5 are omitted. For Error Codes, see *Chapter 5: Maintenance, Section I: Troubleshooting*.

IS-800CA/1400CA Advanced: Screen 07 (Error data) Common data (Schedule No.: 000)

- Error data confirmation (Data reading only)

Item	Contents	Character String	Range
1	Error code 1	nnn,	E01 to E39
2	Error code 2	nn,	01 to 39
3	Error code 3	nn,	01 to 39
4	Error code 4	nn,	01 to 39
5	Error code 5	nn,	01 to 39
6	Error code 6	nn,	01 to 39
7	Error code 7	nn,	01 to 39
8	Error code 8	nn	01 to 39

The number of error codes is of eight max. In the case of only one error code, the items 2 to 8 are omitted.
For error codes, see *Chapter 5: Maintenance, Section I: Troubleshooting*.

- Error reset (Data setting only)

Item	Contents	Character String	Range
1	Error reset	nnn	E00

IS-800CA/1400CA Advanced: Screen 08 FORCE SETUP screen Specific data in accordance with Schedule No. (Schedule No.: 001 to 255)

Example of data writing:
#01W001S08:1,02000,02100,02200,02300,02400,02500,1,0,0,00000,0[CR][LF]

Item	Contents	Character String	Range
1*1	STEP MODE	n,	0:OFF 1:ON
2	PROPVALVE#	n,	1 to 2
3	SQD FORCE	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
4	SQZ FORCE	nnnnn,	
5	WELD1 FORCE	nnnnn,	
6	COOL1/WELD2 FORCE	nnnnn,	
7	COOL2/WELD3 FORCE	nnnnn,	
8	HOLD FORCE	nnnnn,	
9*1	VALVE#	n,	1 to 4
10	FORGE VALVE#	n,	1 to 2
11	CHAINING	n,	0:OFF 1:ON
12	SUCCESSIVE	n,	0:OFF 1:ON
13	FORGE DELAY	nnnnn,	00000 to 30000(ms)
14	FORGE MODE	n	0:OFF 1:ON

*1 Items inhibited from setting (When setting data, omit these items.)
“,” is not transmitted, too.

IS-800CA/1400CA Advanced: Screen 09 DISPLACEMENT screen Specific data in accordance with Schedule No. (Schedule No.: 001 to 255)

Example of data writing:
#01W001S09:0,0,0,0000000,0000000,0000000,+00.000,+00.000,+00.000,+00.000,000[CR][LF]

Item	Contents	Character String	Range
1	WELD1STOP INPUT	n,	0:OFF 1:DISPLC 2:CURR 3:VOLT 4:POWER 5:PULSE
2	WELD2STOP INPUT	n,	
3	WELD3STOP INPUT	n,	
4	WELD1CONDITION	nnnnnnn, +nn.nnn, -nn.nnn, nnnn.nn, nnnnn.n,	WELD STOP INPUT: OFF 0000000 WELD STOP INPUT: DISPLC -99.999 to +99.999(mm) WELD STOP INPUT: CURR 0000.05 to 0005.00(kA) 5kA range 0000.50 to 0009.99(kA) 10kA range 00001.0 to 00020.0(kA) 20kA range 00002.0 to 00040.0(kA) 40kA range 00004.0 to 00080.0(kA) 80kA range*1 WELD STOP INPUT: VOLT 0000.20 to 0009.99(V) WELD STOP INPUT: POWER 0000.05 to 0005.00(kW) 5kA range 0000.50 to 0009.99(kW) 10kA range 00001.0 to 00020.0(kW) 20kA range 00002.0 to 00060.0(kW) 40kA range 00004.0 to 00120.0(kW) 80kA range*1 WELD STOP INPUT: PULSE 00010.0 to 00099.9(%)
5	WELD2CONDITION	nnnnnnn, +nn.nnn, -nn.nnn, nnnn.nn, nnnnn.n,	
6	WELD3CONDITION	nnnnnnn, +nn.nnn, -nn.nnn, nnnn.nn, nnnnn.n,	
7	WORKDETECTLIMIT HIGH	+nn.nnn, -nn.nnn,	-99.999 to +99.999(mm)
8	WORKDETECTLIMIT LOW	+nn.nnn, -nn.nnn,	-99.999 to +99.999(mm)
9	DISPLACEMENT LIMIT HIGH	+nn.nnn, -nn.nnn,	-99.999 to +99.999(mm)
10	DISPLACEMENT LIMIT HIGH	+nn.nnn, -nn.nnn,	-99.999 to +99.999(mm)
11	DISPLACEMENT DELAY TIME	nnn	000 to 999(ms)

*1 **ISB-1400A** only

IS-800CA/1400CA Advanced: Screen 10 PRESSURE REGULATOR screen Common data (Schedule No.: 000)

Example of data writing:
#01W000S10:1,0,0,200.0,0.40,00000,00000,00000,000.0,0.00,00000,00000,00000[CR][LF]

Item	Contents	Character String	Range
1	FORCE CONTROL MODE	n,	1 to 4
2	FORCE UNIT	n,	0:N 1:kgf 2:lbf
3	AIR PRESSURE UNIT	n,	0:Mpa 1:bar 2:psi
4	AIR CYLINDER DIAMETER of VALVE1	nnn.n,	000.0 to 500.0(mm)
5	MAX AIR PRESSURE of VALVE1	n.nn, nn.n, nnnn,	0.00 to 1.00(Mpa) 00.0 to 10.0(bar) 0000 to 0145(psi)
6*1	MAXFORCE of VALVE1	nnnnn,	00000 to 99999(N) 00000 to 99999(kgf) 00000 to 99999(lbf)
7*1	CONSTANT FORCE UP/DW of VALVE1	n,	0:UP 1:DOWN
8	CONSTANT FORCE of VALVE1	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
9*1	CONSTANT LOW UP/DW of VALVE1	n,	0:UP 1:DOWN
10	CONSTANT LOW of VALVE1	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
11*1	CONSTANT HIGH UP/DW of VALVE1	n,	0:UP 1:DOWN
12	CONSTANT HIGH of VALVE1	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
13	AIR CYLINDER DIAMETER of VALVE2	nnn.n,	000.0 to 500.0(mm)
14	MAX AIR PRESSURE of VALVE2	n,nn, nn.n, nnnn,	0.00 to 1.00(Mpa) 00.0 to 10.0(bar) 0000 to 0145(psi)
15*1	MAX FORCE of VALVE2	nnnnn,	00000 to 99999(N) 00000 to 99999(kgf) 00000 to 99999(lbf)
16*1	CONSTANT FORCE UP/DW of VALVE2	n,	0:UP 1:DOWN
17	CONSTANT FORCE of VALVE2	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)
18*1	CONSTANT LOW UP/DW of VALVE2	n,	0:UP 1:DOWN
19	CONSTANT LOW of VALVE2	nnnnn,	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)

*1 Items inhibited from setting (When setting data, omit these items.)
“,” is not transmitted, too.

Example of data writing:
#01W000S10:1,0,0,200.0,0.40,00000,00000,00000,000.0,0.00,00000,00000,00000[CR][LF]

Item	Contents	Character String	Range
20*1	CONSTANT HIGH UP/DW of VALVE2	n,	0:UP 1:DOWN
21	CONSTANT HIGH of VALVE2	nnnnn	00000 to 35000(N) 00000 to 03569(kgf) 00000 to 07868(lbf)

*1 Items inhibited from setting (When setting data, omit these items.)
“,” is not transmitted, too.

APPENDIX G
EtherNet/IP™ Communications

Section I. Introduction

Introduction

This appendix will provide the instructions on how to setup the connectivity from an Allen Bradley® PLC to the AMADA WELD TECH IS-800CA / 1400CA Inverter Power Supply via an EtherNet/IP™ bus controller (X20BC0088). The machine builder / user who integrates the IS-800CA / 1400CA EtherNet/IP™ communication installation kits should have some working knowledge with the Allen Bradley® PLC and the RSLogix5000 programming logics.

The EtherNet/IP™ bus controller (X20BC0088) that is built into the IS-800CA / 1400CA, includes modules that serve as communication adapters between the IS-800CA / 1400CA and the Allen Bradley® PLC. This allows the reading and writing of the digital I/O's, analog I/O's and serial communication screen data to / from the IS-800CA / 1400CA Inverter Power Supply via any EtherNet/IP™ protocol scanner like an Allen Bradley® host PLC.

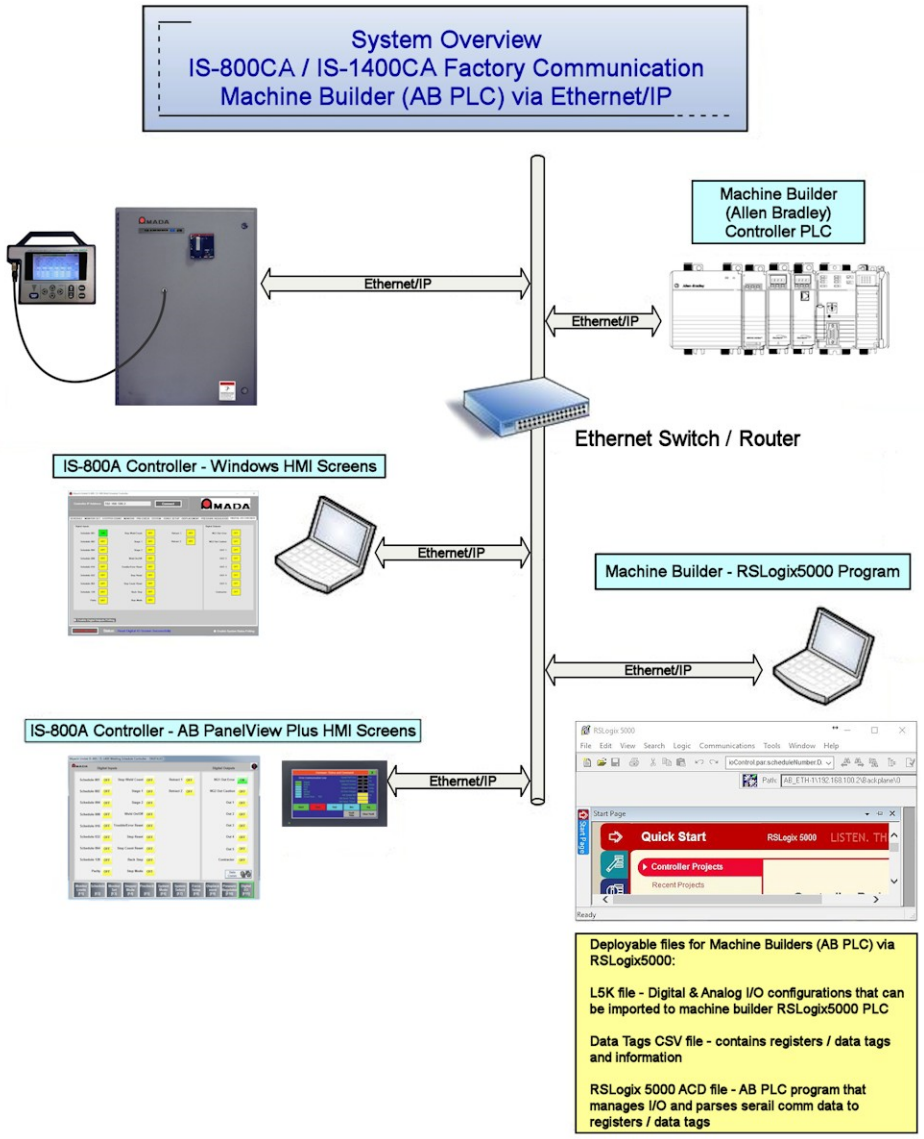
The IS-800CA / 1400CA **EtherNet/IP™** support files are located on the USB Flash Memory that was shipped with your Power Supply (P/N # 4-40965-01). These support files include:

- A functional sample program of the Allen Bradley® 1769-L32E PLC that communicates to the Bus Controller. This file is located under the folder:
  \IS_Series_AB_EthernetIP\RSLogix_PLC (40368)\IS_1769_L32E.ACD
- An **.L5K digital & analog I/O configurations file. This file is located under the folder:
  \IS_Series_AB_EthernetIP\RSLogix_PLC (40368)\Importable\IS_1769-L32E.L5K
- Data Types / Tags / Program Routines. These files are located under the folders:
  \IS_Series_AB_EthernetIP\RSLogix_PLC (40368)\Importable\DataTypes
  \IS_Series_AB_EthernetIP\RSLogix_PLC (40368)\Importable\Tags
  \IS_Series_AB_EthernetIP\RSLogix_PLC (40368)\Importable\Programs
- IS-800CA / 1400CA Weld Schedule Controller Windows Application. This file is located under the folder:
  \IS_Series_AB_EthernetIP\Windows_EthernetIP_WeldControl (40713)\
- Panel View Plus HMI. This Factory Talk ME Runtime support file is located under the folder:
  \IS_Series_AB_EthernetIP \PanelViewPlus_EthernetIP_WeldControl (40715)\

This appendix will provide the user;

- How to setup the IP address of the EtherNet/IP™ bus controller via webserver.
- Two available options for configuring the bus controller communication with Allen-Bradly® PLC Software:
  a. Automatic configuration (via a pre-generated .L5K configuration)
  b. Manual configuration (user configured).
- How to import data types, tags, program routines to a PLC.

System Hardware Overview



Section II. Setting up the Bus Controller IP Address

By default, the bus controller is pre-configured with an IP address of 192.168.100.1 (subnet 255.255.255.0). If the Allen Bradley® PLC also has a pre-configured IP address in this range (ex. 192.168.x.x), then the bus controller IP address does not need to be modified. The user can skip all of the steps under this Section II and proceed on to Section III. If the Allen Bradley® PLC has a preconfigured IP address of something other than 192.168.x.x, for instance in the 10.0.0.2 range with (subnet 255.0.0.0), then follow the steps below to configure the bus controller IP address.

Setting up the IP Address of the Bus Controller

In order to connect to the bus controller webserver via a web browser at IP address 192.168.100.1, we want to make sure that the current bus controller is not configured to some other unknown IP address. Set both rotary switches to "F" position and cycle the power. The Bus Controller will automatically reset the bus controller IP address back to the default IP address of 192.168.100.1.

The image on the left shows the switch position is at "0 0" position. To switch to "F F" position, turn both knobs counter-clockwise by one tick from the "0" position to the "F" position. The Bus Controller will now boot with default values:

FF

IP address: 192.168.100.1
Network mask: 255.255.255.0
Gateway: 192.169.100.254

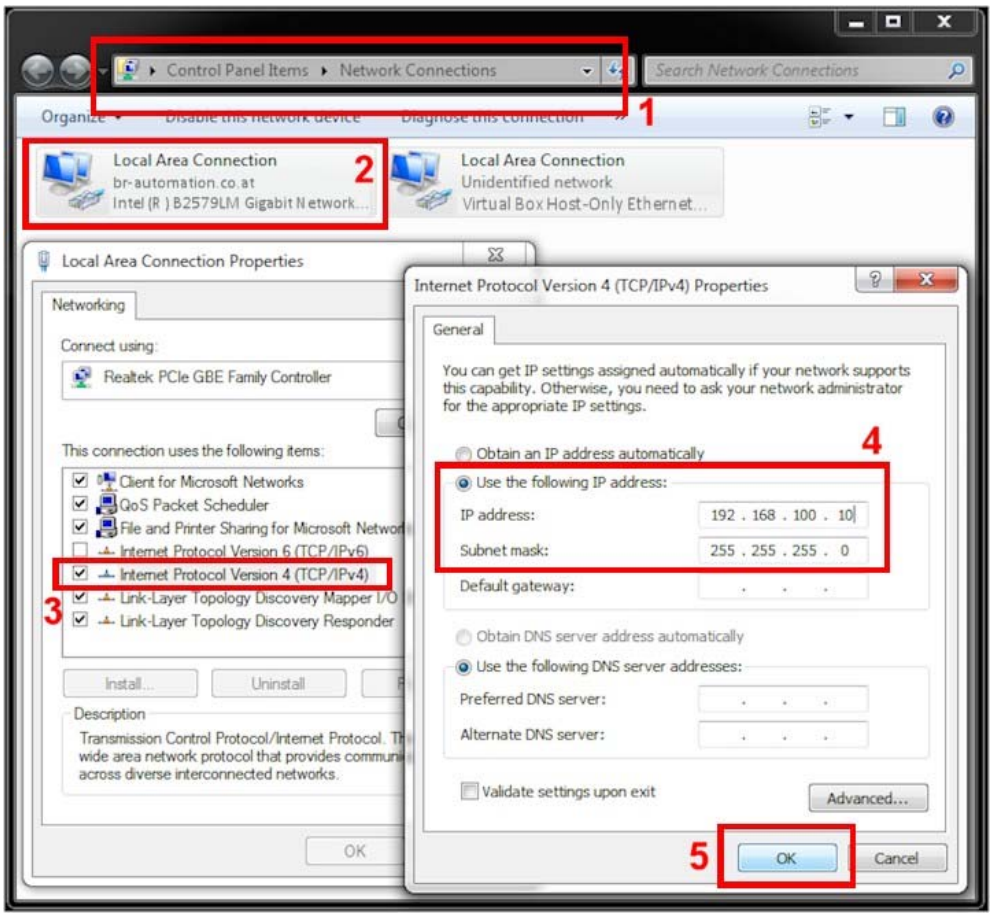
Note: The IP address stored in the flash memory is not changed.

Setting up the Local Area Connection

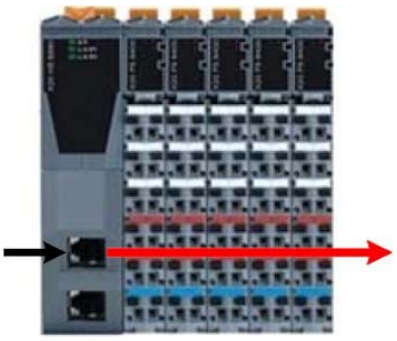
Set the IP address on your PC:

192.168.100.x (example: 192.168.100.10)

Note: Do not set "x" to 1, this IP address is reserved for the Bus Controller



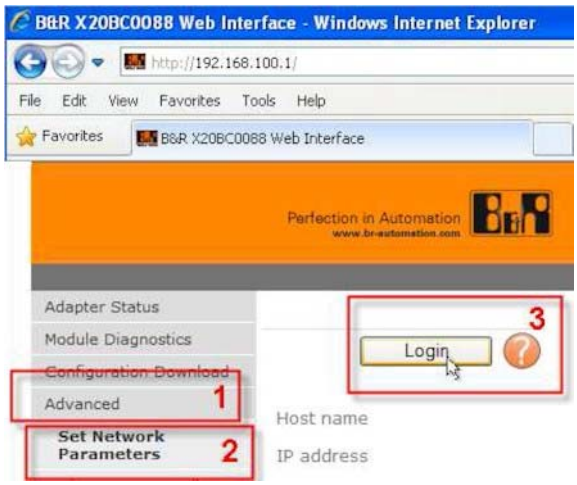
Connect the PC/Laptop directly to the first network connection port on the Bus Controller with a CAT 5E cable as shown on the right.



X20BC0088

Now the web server can be started from any browser by calling the IP address 192.168.100.1.

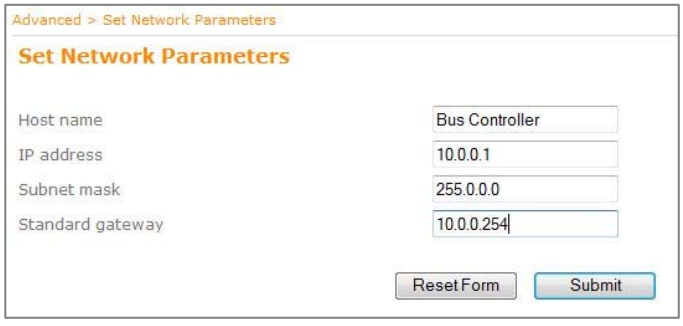
Go to **Advanced** > **Set Network Parameters** and Select on [Login].



Enter the *User name* and *Password* as shown, then select [OK].

User name: admin
Password: X20BC0088

Now the bus controller IP address can be modified to a different IP (10.0.0.1) by setting all the parameters as shown on the right. Then select [Submit] and change the Bus Controller switch position back to "0 0" and power cycle to the bus controller unit. The bus controller should now boot with IP address of 10.0.0.1



Section III. Configuring the Bus Controller with an Allen Bradley® PLC

There are two options on how to add a Bus Controller Ethernet communication module to an Allen Bradley® PLC .ACD project.

- Option 1 - Add an Ethernet communication module to a new ACD project on an Allen Bradley® PLC (refer to page G-7).
- Option 2 - If the machine builder already has an existing functional Allen Bradley® PLC ACD project, this option will show how to add the Ethernet module through the RSLogix5000 backplane and import the data types, tags and program routines (refer to page G-12).

Refer to the appropriate section below for details of each option.

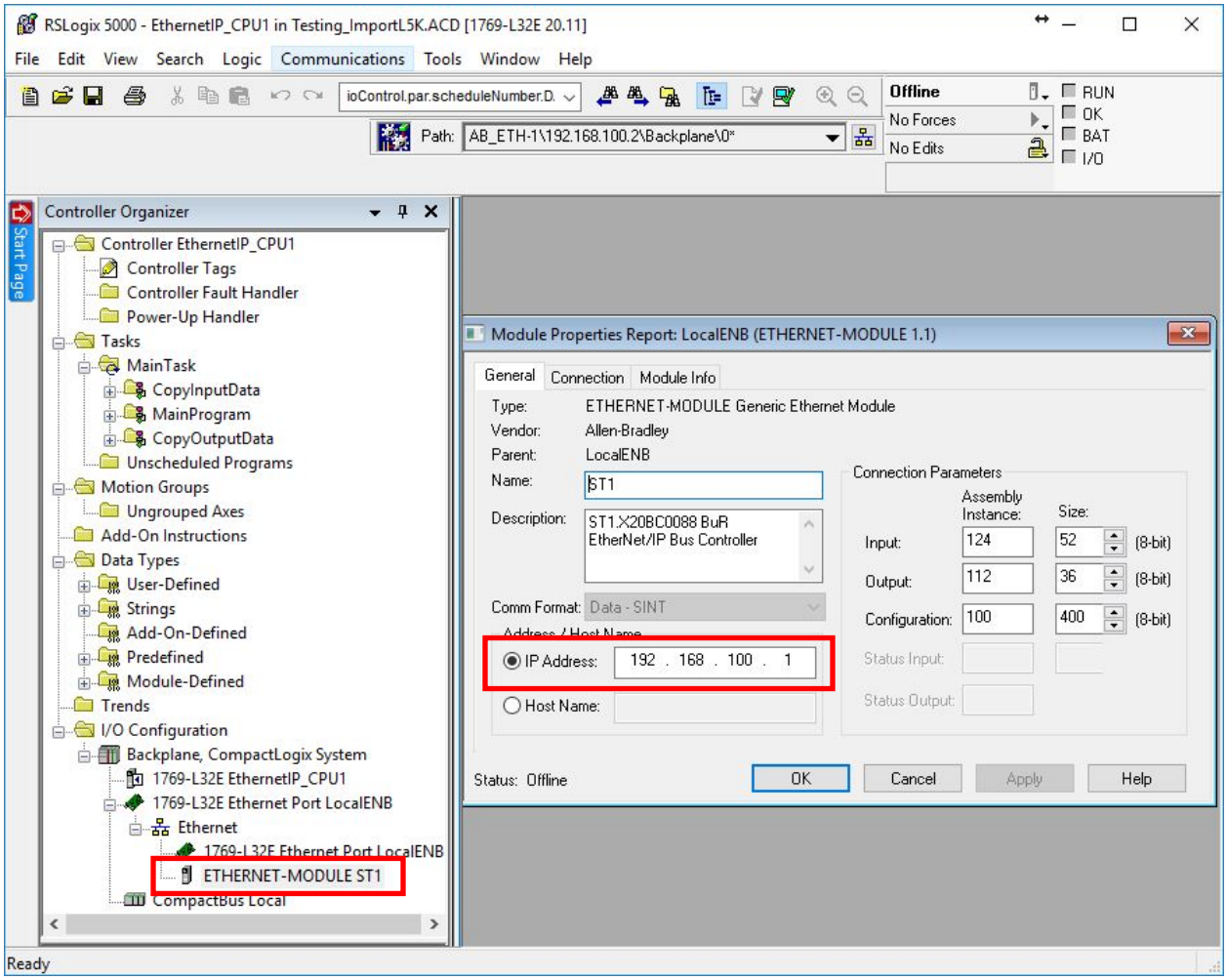
Option 1 – Add Ethernet Communication Module to New ACD Project

Allen Bradley® 1769 or 1756 PLC

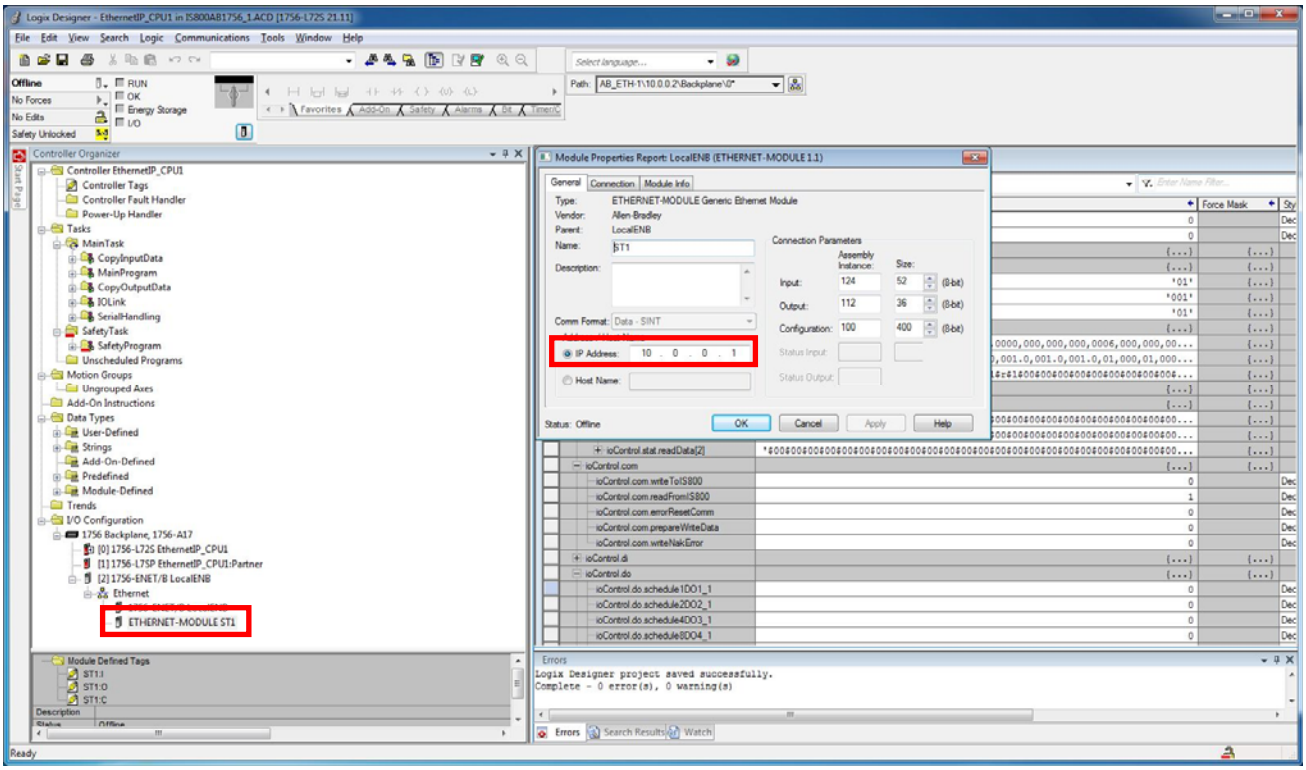
If the machine builder PLC is either an AB1769 or AB1756, there is already a pre-configured, tested, sample of IS_1769_L32E.ACD and IS_1756_L72S.ACD (respectively) included in the installation package that contains the PLC programming routines and logic ready for controlling the IS-800CA / 1400CA digital I/O and reading/writing serial communication data. The machine builder can use these samples as a starting point for an .ACD project. These sample *.ACD files are located under the *\IS_Series_AB_EthernetIP\RSLogix_PLC* folder of the installation package.

After the *.ACD project is opened, make sure that the Module IP address matches the Bus Controller IP address which was assigned in Section II above. Double-click on the **ETHERNET-MODULE ST1** as shown below to open the *Module Properties Report* window and verify the IP address. If the bus controller IP address is different than the IP Address under module properties window as shown below, modify it to the correct IP address.

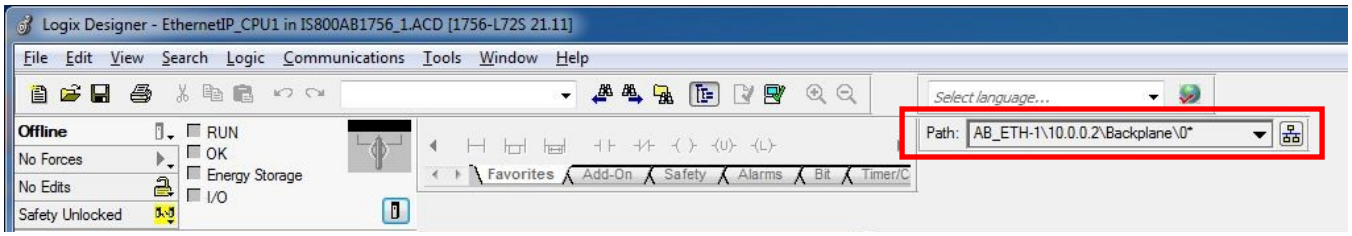
Example 1: IS_1769_L32E.ACD has the Bus Controller IP address pre-assigned with 192.168.100.1.

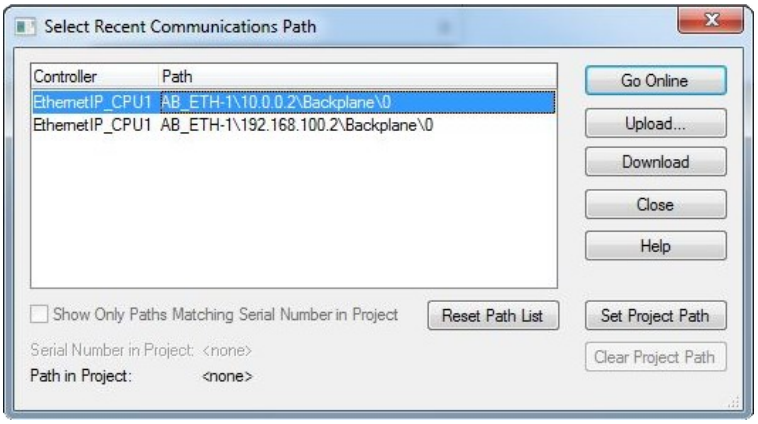


Example 2: IS_1769_L32E.ACD has the Bus Controller IP address pre-assigned with 10.0.0.1.



Before downloading this opened ACD project, make sure the Project Path to the controller backplane is set correctly. If not, select the [Who Active] icon to select and set the correct PLC path.

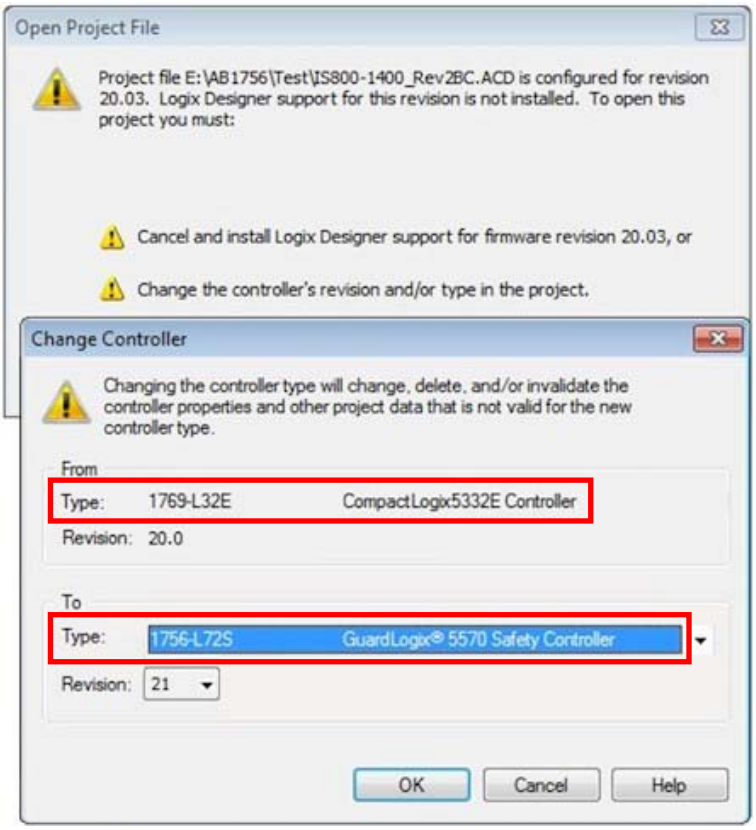




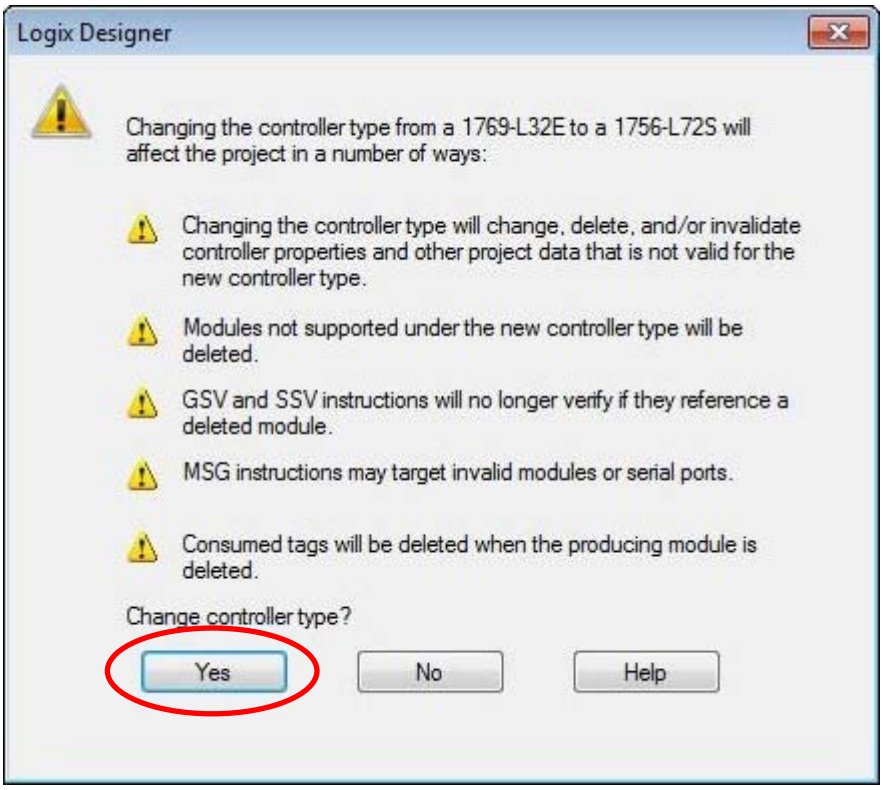
Other Allen Bradley® PLC's

If the machine builder PLC is **NOT** AB1769 or AB1756, the machine builder can open either the included IS_1769_L32E.ACD or IS_1756_L72S.ACD (respectively) and convert to their Allen Bradley controller type. The sample steps below demonstrate how to open an existing IS_1769_L32E.ACD and convert it to the machine builder PLC, assume it is an Allen Bradley® 1756.

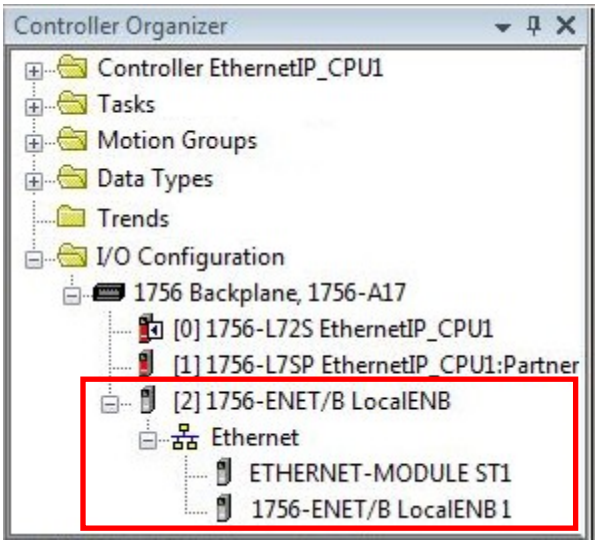
Open the ACD project file *\IS_Series_AB_EthernetIP\RSLogix_PLC\IS_1769_L32E.ACD* from the RSLogix5000. When RSLogix5000 detects the IS_1769_L32E.ACD is from another controller, it would prompt the user to select the controller to convert to. Choose the *To Type:* controller with **1756-L72S** from the dropdown selection.



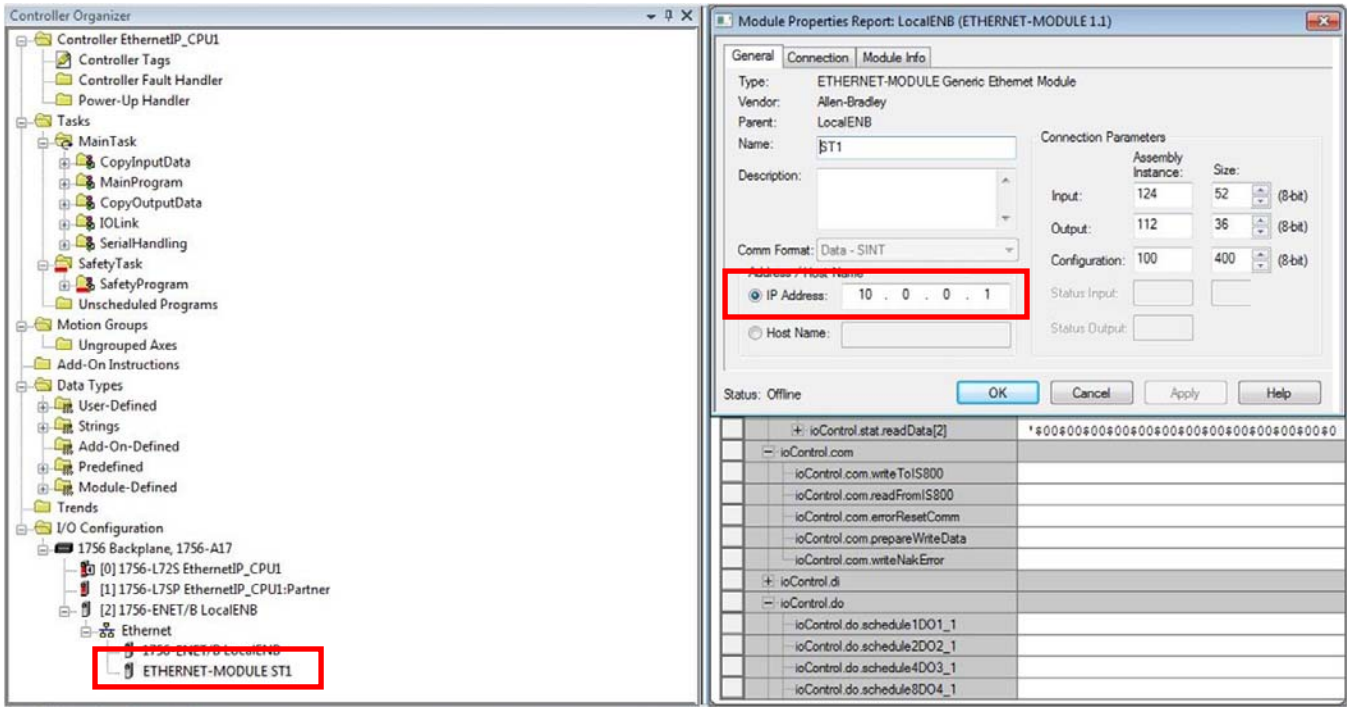
Then select [YES] to confirm



If the ACD project is converted successfully, it should include the Ethernet communication module as shown below. All of the Controller Tags, Task program routines and Data Types should be converted and included as well. Therefore no additional data importing is required.



The machine builder/user would only need to verify that the bus controller IP address to connect to is correct by double-clicking on the **ETHERNET-MODULE ST1** to open the *Module Properties Report* window and verify the IP address.



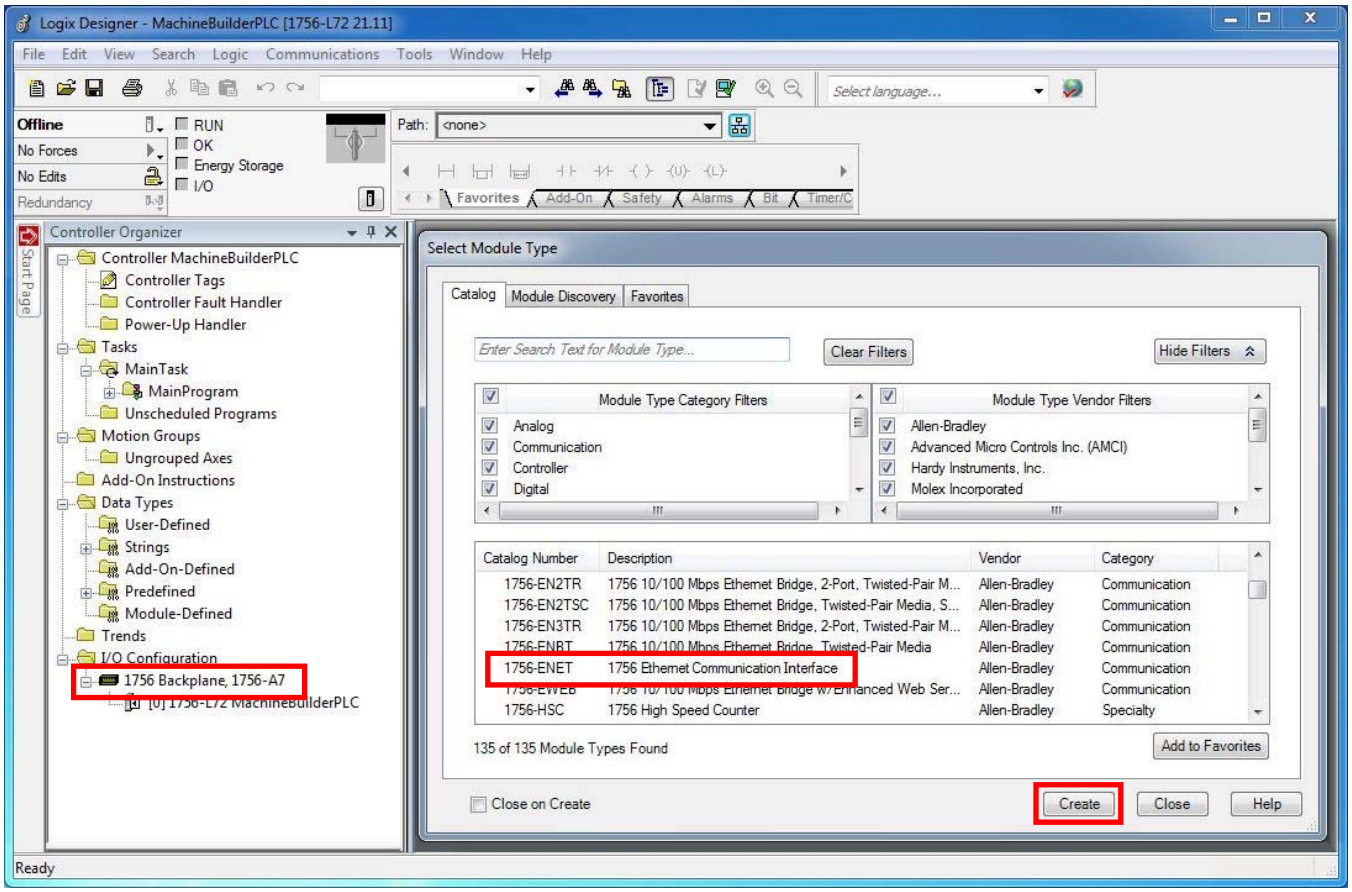
If for some reason the ACD controller type conversion failed to add the Ethernet Communication Module, follow the steps under the next section (Option 2) on how to add the Ethernet communication module.

Option 2 – Add Ethernet Communication Module to an Existing ACD

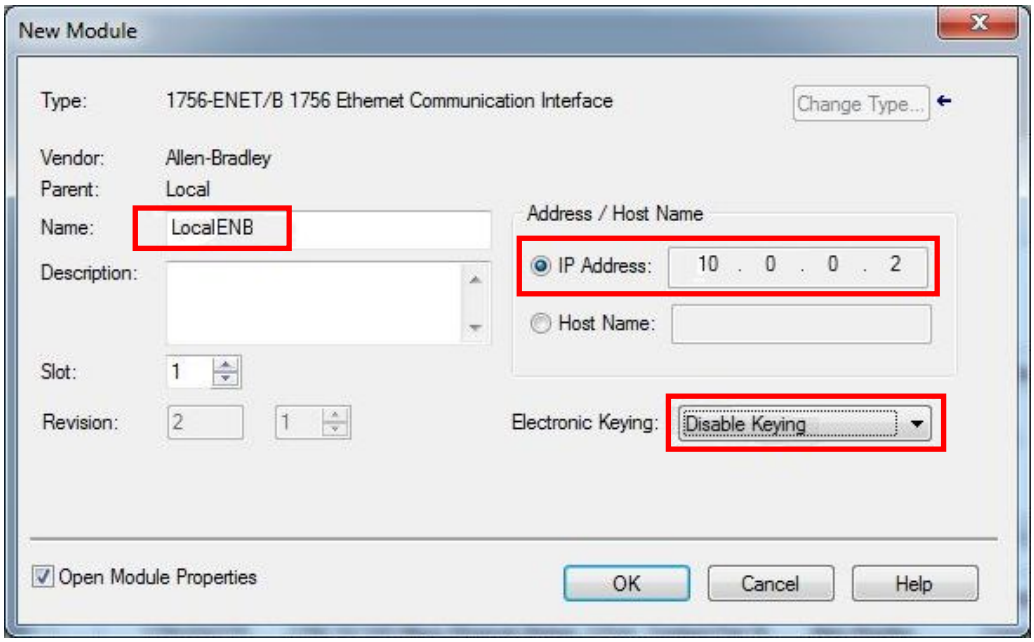
If the machine builder already has an existing functional Allen Bradley® PLC ACD project, this option will show how to add the Ethernet module through the RSLogix5000 backplane and import the data types, tags and program routines.

To add a new Ethernet communication module, first, highlight the **'PLC' backplane** and perform a right-mouse select and then choose the *Select New Module* option from the popup menu to define a new Ethernet Interface.

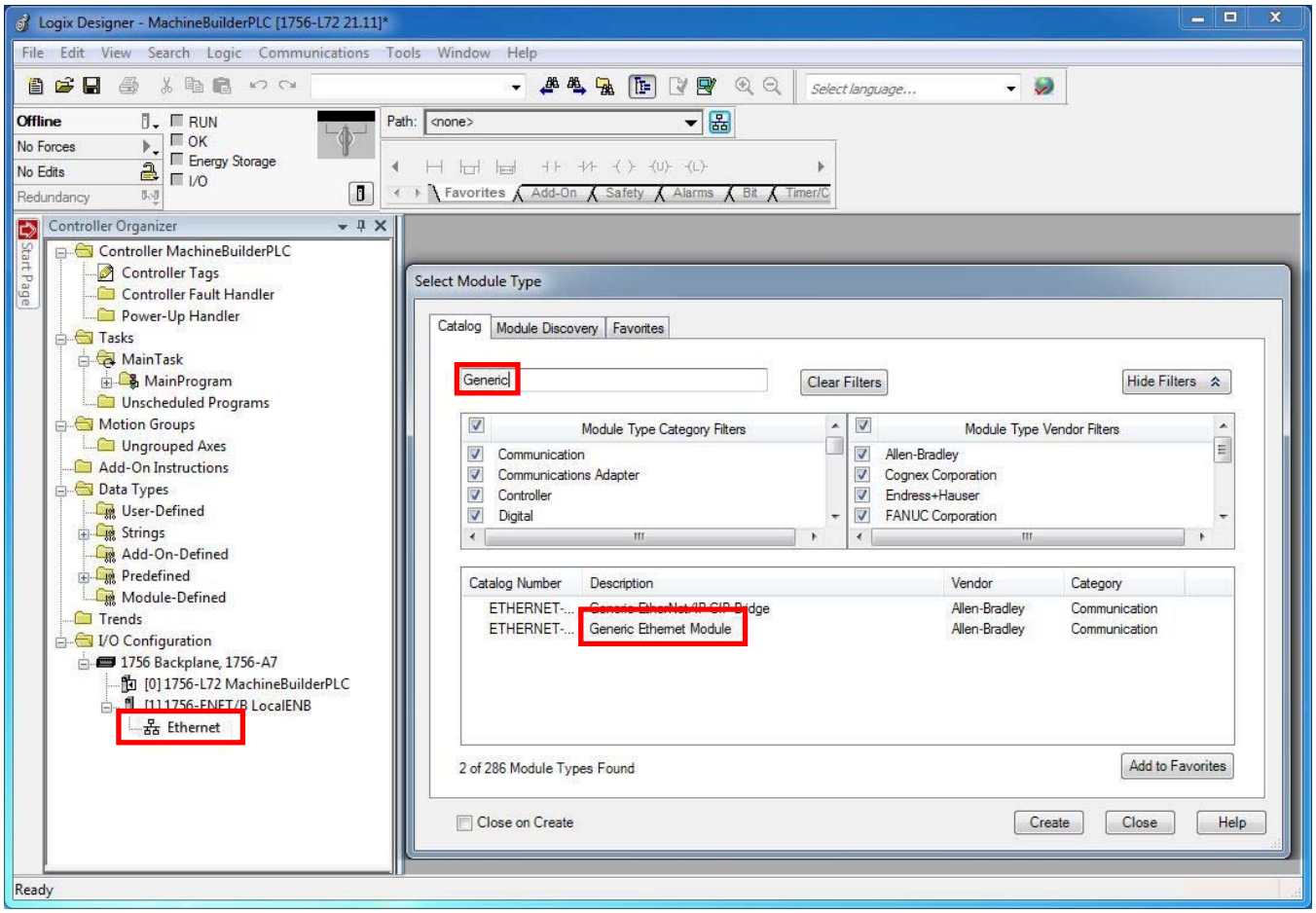
When the *Select Module Type* window appears, select the **1756 Ethernet Communication Interface** option and then select the [Create] button.



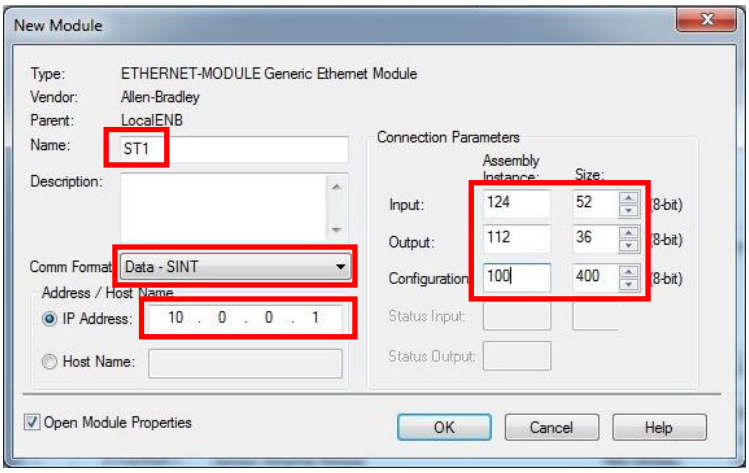
When the *New Module* window is opened, enter the name *LocalENB* and IP Address of the Allen Bradley® PLC. In this example, the IP address 10.0.0.2 is used. Under the **Electronic Keying** selection, choose the *Disable Keying* selection. Select [OK] when finished.



Then highlight the *Ethernet* item, perform a right-mouse select and select **New Module**. When the *Select Module Type* window appears, enter the word *Generic* in the search field to search for all of Generic Ethernet modules and select the **Generic Ethernet Module**. Select [Create] to open a new Ethernet communication module.

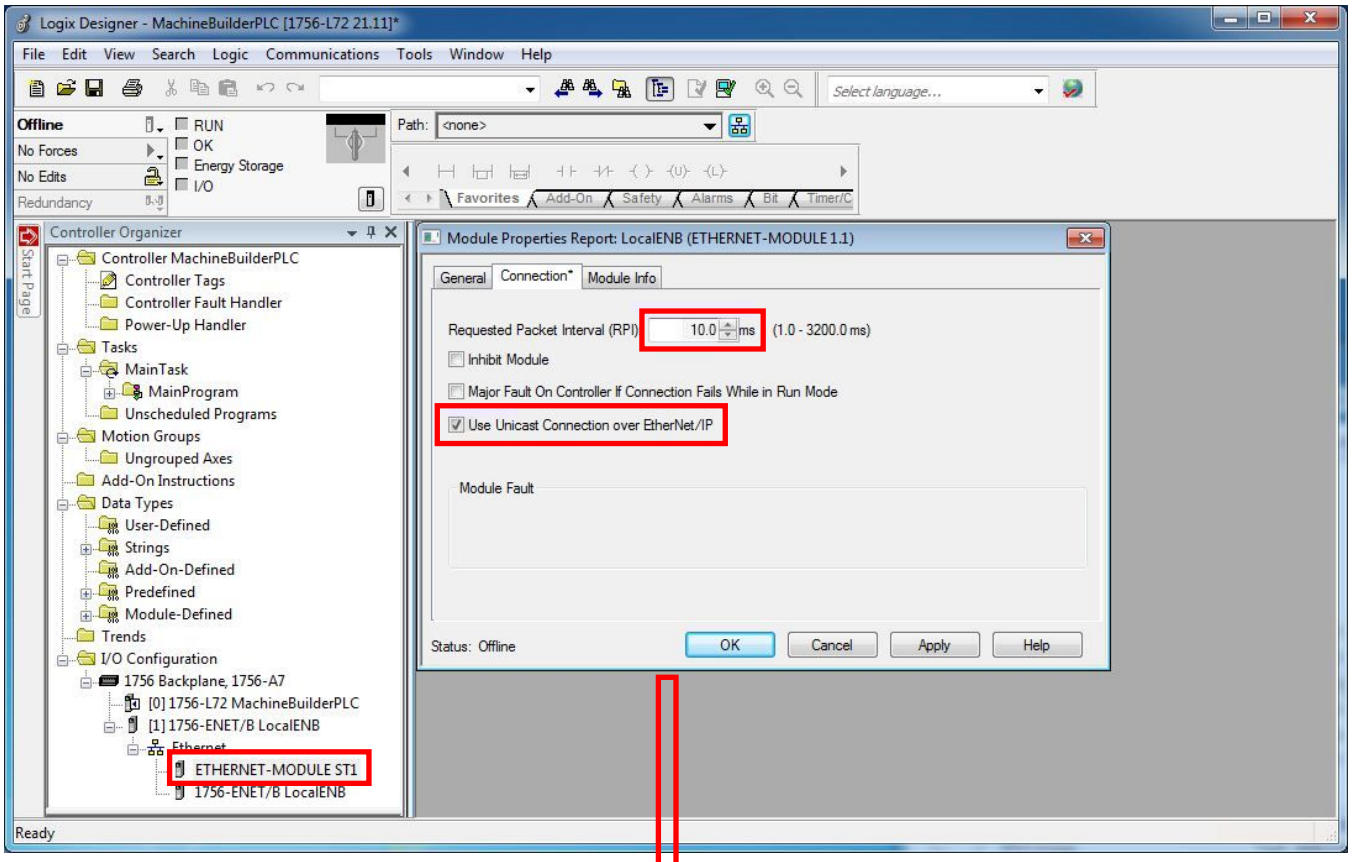


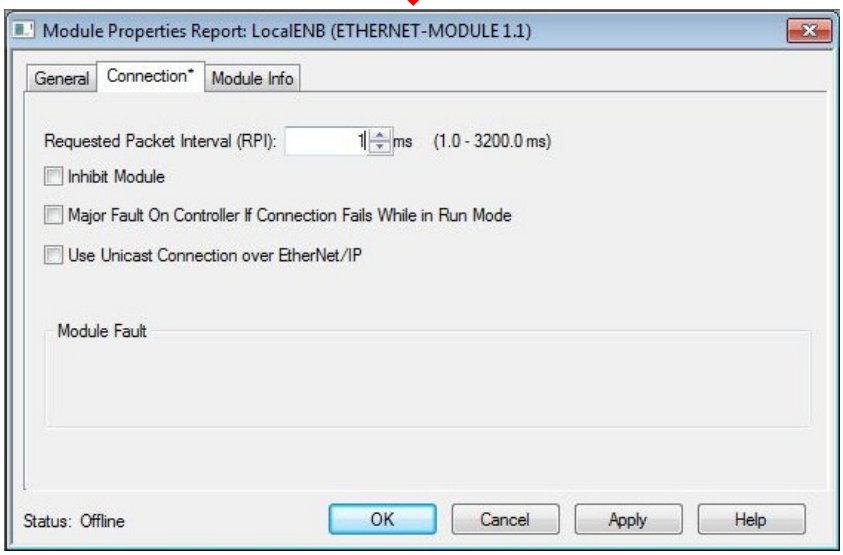
When the New Module window appears, enter the data as shown below, then select [OK].



Select the "Connection" tab and change the highlight fields as shown below:

- Requested Packet Interval (RP1) from *10.0* ms to *1.0* ms
- Uncheck the *Use Unicast Connection over EtherNet/IP*

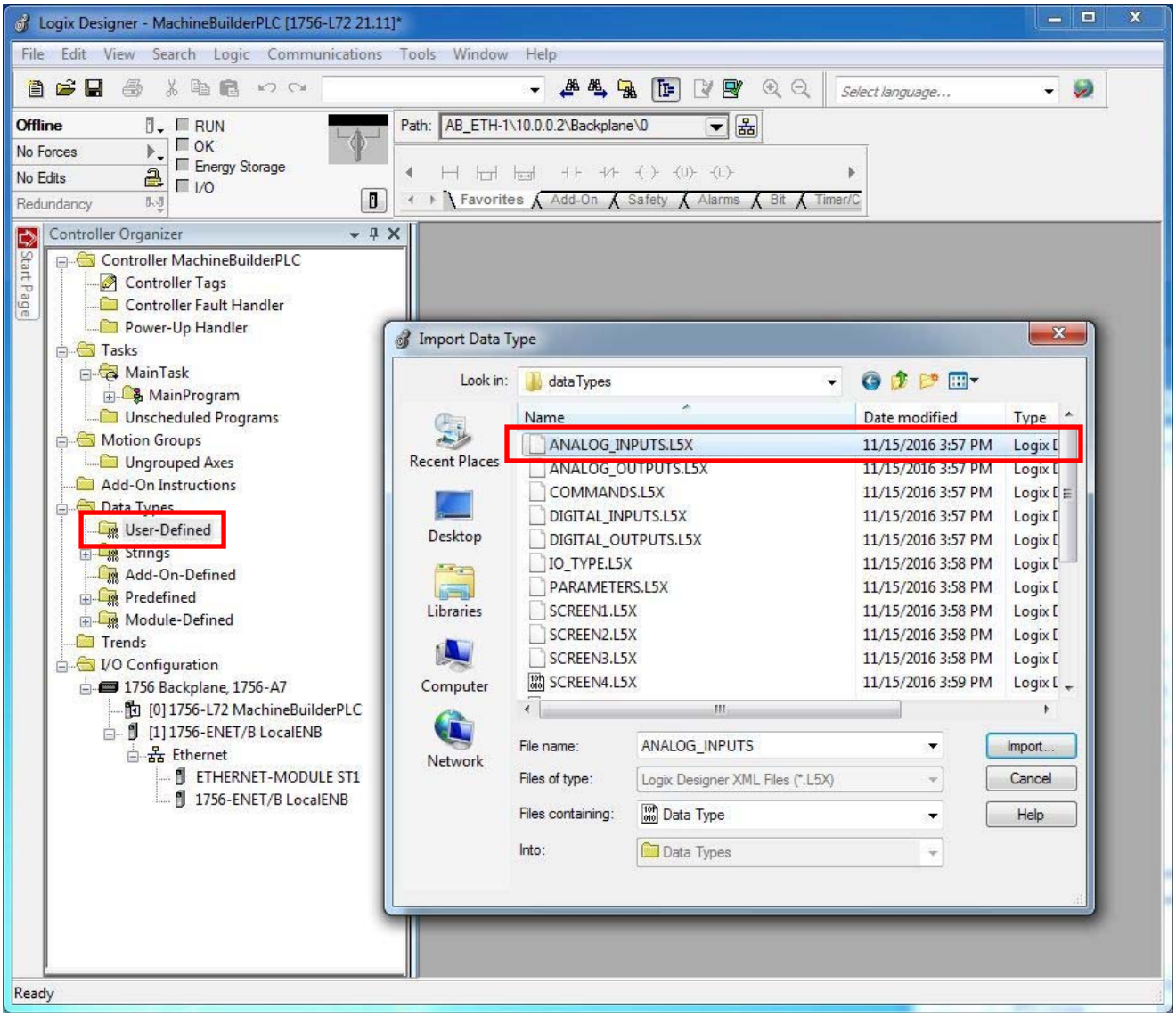




Select [OK] when changes are complete.

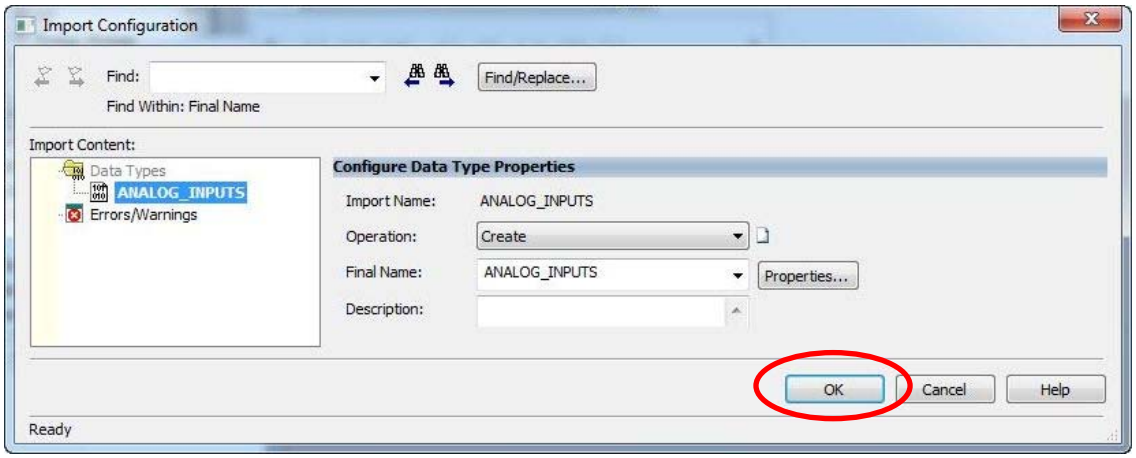
Importing Data Types

Under **Data Types** > **User-Defined**, select *User-Defined* and perform a right-mouse select. Select the Import option from the popup menu. When the Import Data Type window appears, navigate to the installation package *\IS_Series_AB_EthernetIP\RSLogix_PLC\Importable\DataTypes* folder. Select each of the *.L5X items from this folder to import the data types.



Select the “ANALOG_INPUTS.L5X” item and select the [Import] button.

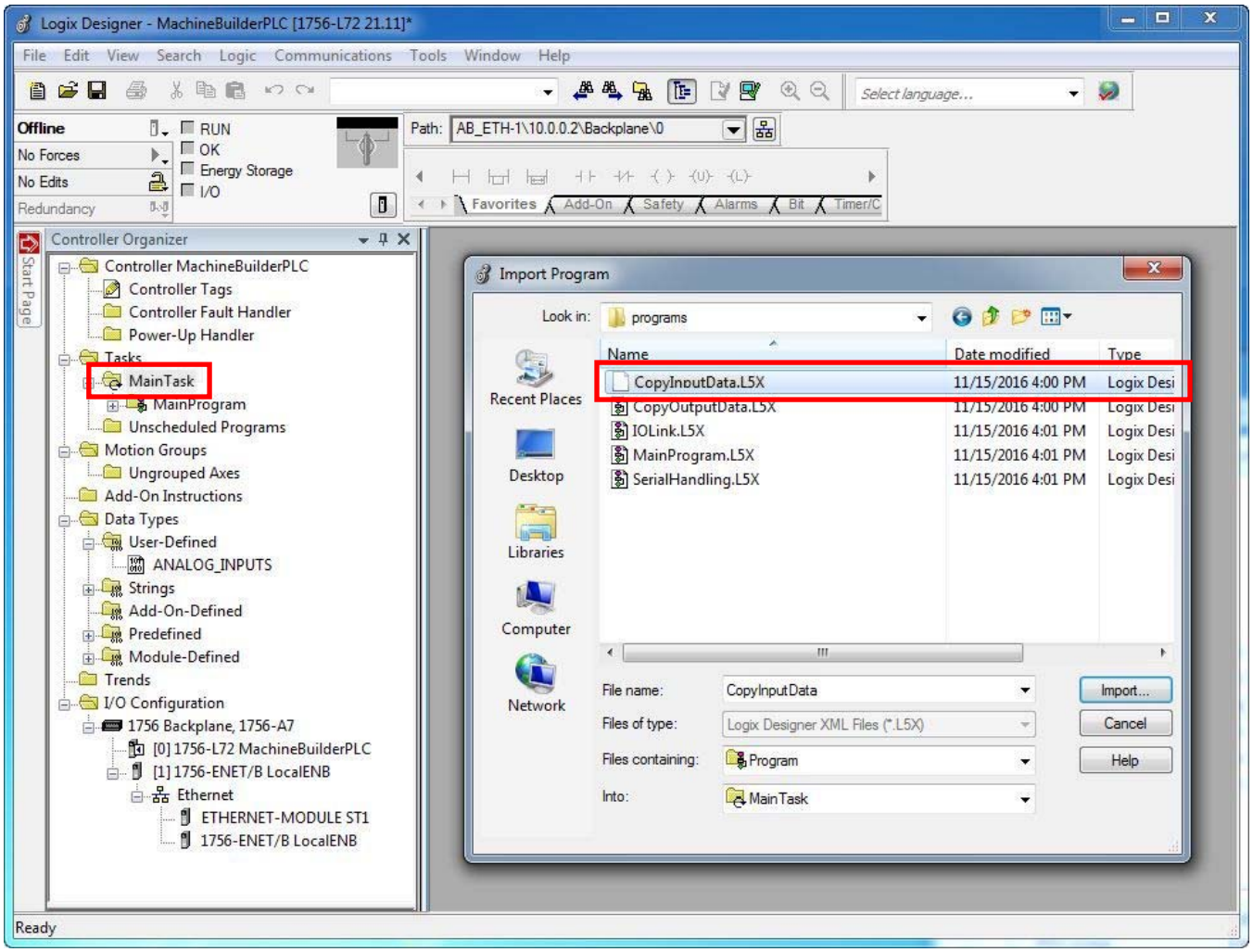
When the Import Configuration window opens, select [OK] to continue.



Repeat the import steps until all of *.L5X data type items get imported into the ACD project.

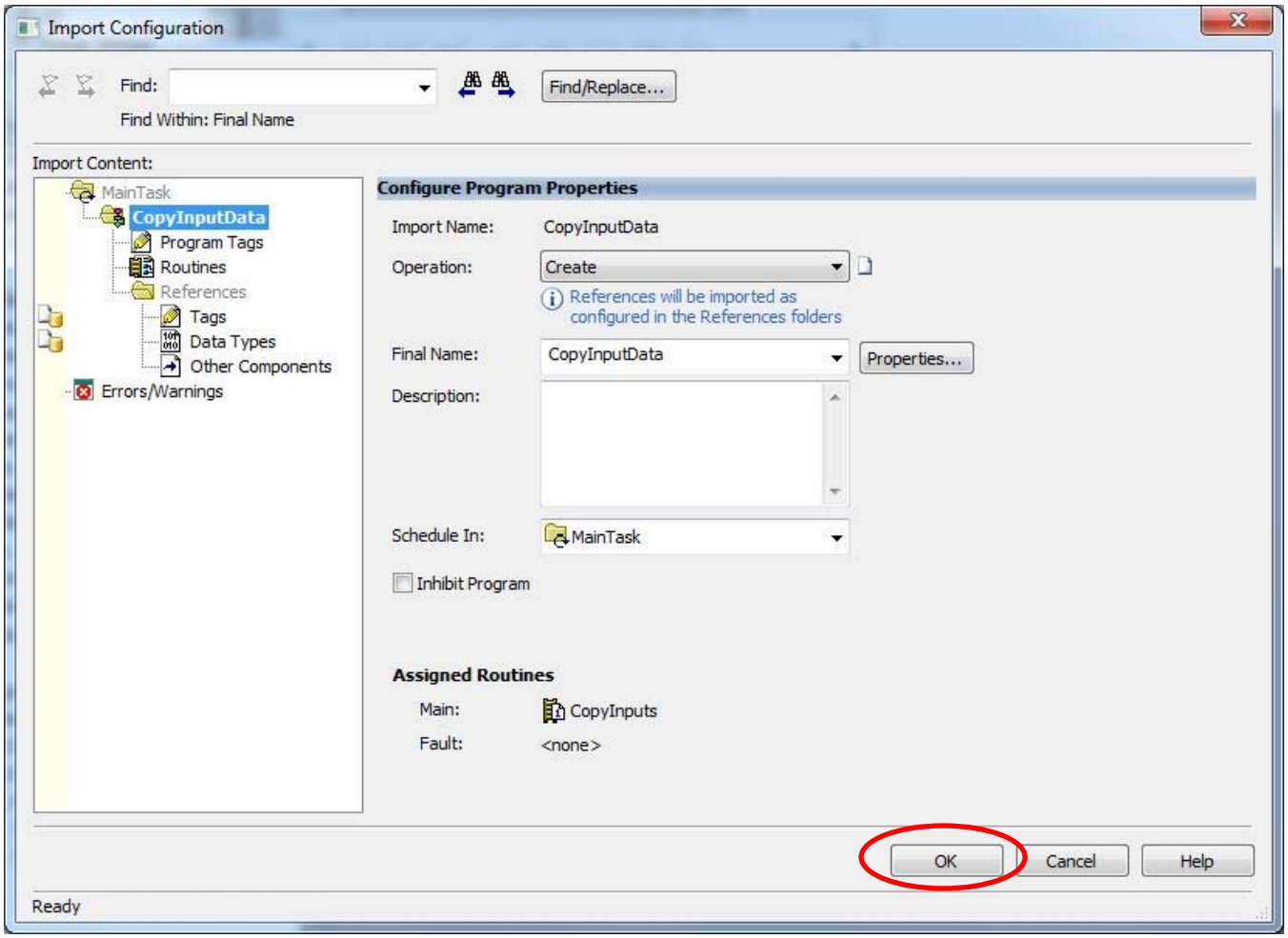
Task Programs / Routines

Under **Tasks** > **MainTask**, select *MainTask* and perform a right-mouse select. Select the **Import** option from the popup menu. When the *Import Program* window is opened, navigate to the installation package *\IS_Series_AB_EthernetIP\RSLogix_PLC\Importable\programs* folder. Select each of the *.L5X item from this folder to import the programs.



Select the *CopyInputData.L5X* item and select the [Import] button.

When the *Import Configuration* window is open, select [OK] to continue.



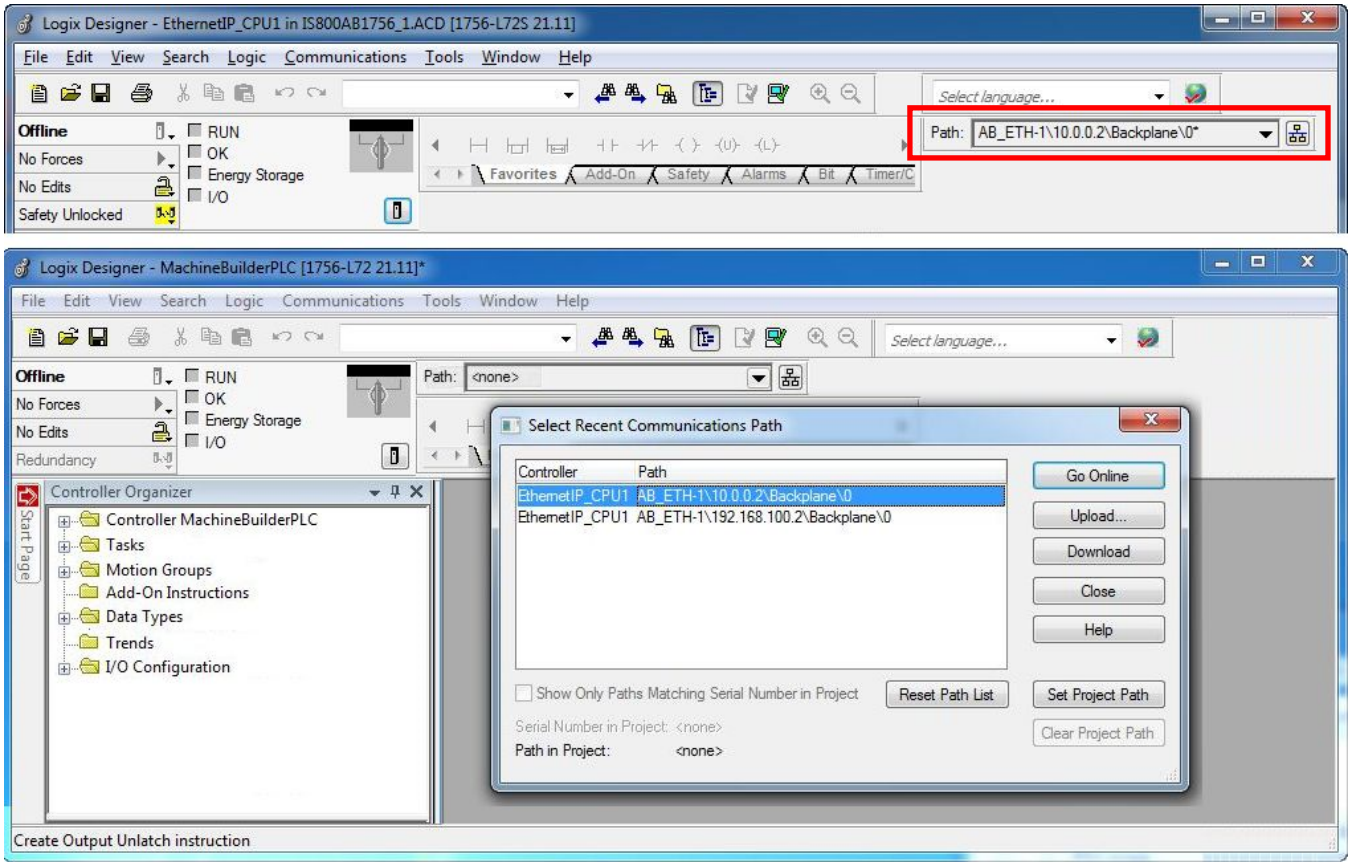
Repeat the import steps until all of *.L5X program items get imported into the ACD project.

Controller Tags

From the *Tools* menu, select **Import** > **Tags and Logic Comments…**

When the Import window opens, navigate to the installation package *\IS_Series_AB_EthernetIP\ RSLogix_PLC\Importable\Tags* folder and select the *IS800-Controller-Tags.CSV* item. Select [Import] to continue.

Before downloading this machine builder ACD project to the PLC and Go Online in the RUN mode, make sure the Project *Path* to the controller backplane is set correctly. If not, select the [Who Active] icon to select and set the correct PLC path.

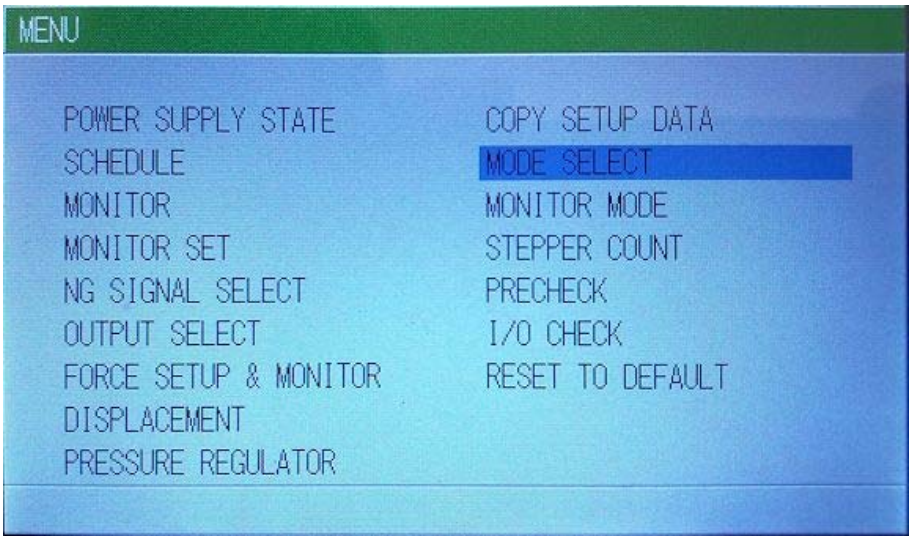


Section IV. System Configurations

Communication Settings

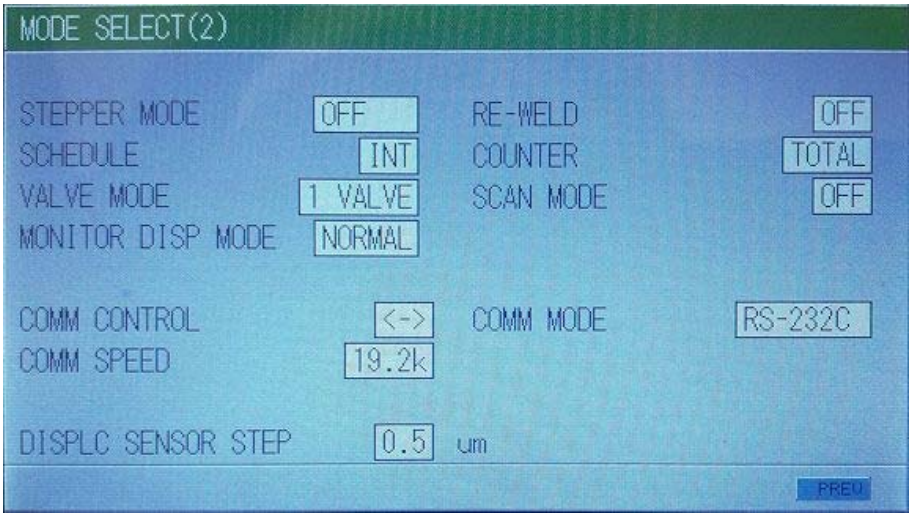
Before running the RSLogix 5000 PLC and putting it online to communicate with the IS-800CA / 1400CA via the bus controller, make sure the serial communication mode is configured correctly in the MA-660 Pendant.

From the **Menu** screen, select the [Mode Select] screen

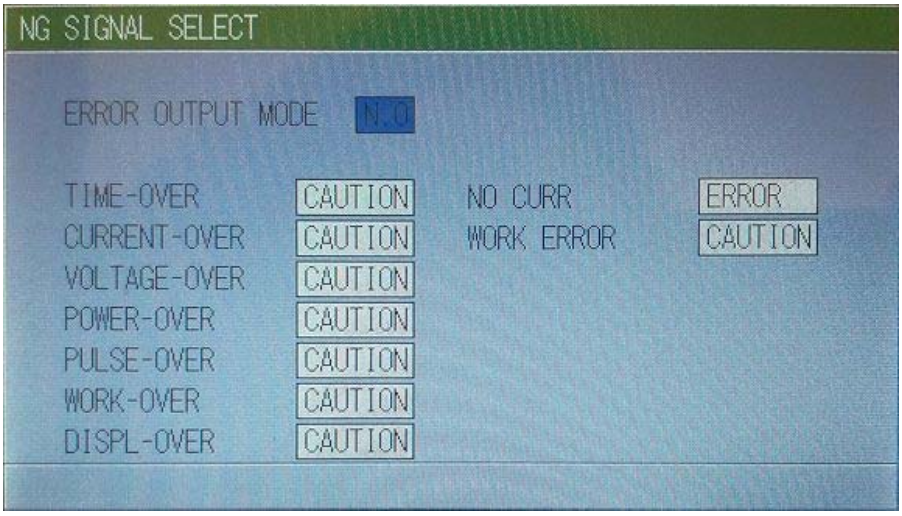


Navigate to the [NEXT] button at the bottom, then press [ENTER] to advance to the next **Mode Select(2)** screen.

On this screen, make sure the *COMM CONTROL*, *COMM MODE* and *COMM SPEED* are set to; "bi-directional [<−>]", "RS-232C" and "19.2k" baud rate respectively as shown below.



From the **Menu** screen, select the [NG Signal Select] and make sure the *ERROR OUTPUT MODE* is set as [N.O.] normal open.



IS-800CA / 1400CA Type Settings

Each IS-Series type will have a different range of power level and limitations and must be specified so the Allen Bradley® Controller PLC knows which IS-Series Inverter Power Supply type (IS-800CA or IS-1400CA) it is communicating with. Open the Controller Tag and assign the iInverterType data tag with the specified value:

- IS-800CA – set the iInverterType = 3

Name	Value	Force Mask	Style	Data Type	Description
copyInpCounter	0		Decimal	DINT	Copy input task repeat counter
copyOutCounter	0		Decimal	DINT	Copy output task repeat counter
fivezeroString	''	{...}		STRING	
iInverterType	3		Decimal	SINT	2 - IS-300CR 3 - IS-800CR 4 - IS-1400CR 5 - IS-2200CR 6 - IS-4500CR
iMonDataPollRate	3000		Decimal	DINT	Monitor Data Screen4 Polling Rate (ms)
ioControl	{...}	{...}		IO_TYPE	
iSysStatusPollRate	2000		Decimal	DINT	System Alarm Screen7 Polling Rate (ms)

- IS-1400CA – set the iInverterType = 4

Name	Value	Force Mask	Style	Data Type	Description
copyInpCounter	0		Decimal	DINT	Copy input task repeat counter
copyOutCounter	0		Decimal	DINT	Copy output task repeat counter
fivezeroString	''	{...}		STRING	
iInverterType	4		Decimal	SINT	2 - IS-300CR 3 - IS-800CR 4 - IS-1400CR 5 - IS-2200CR 6 - IS-4500CR
iMonDataPollRate	3000		Decimal	DINT	Monitor Data Screen4 Polling Rate (ms)
ioControl	{...}	{...}		IO_TYPE	
iSysStatusPollRate	2000		Decimal	DINT	System Alarm Screen7 Polling Rate (ms)
mainCounter	0		Decimal	DINT	Main task repeat counter

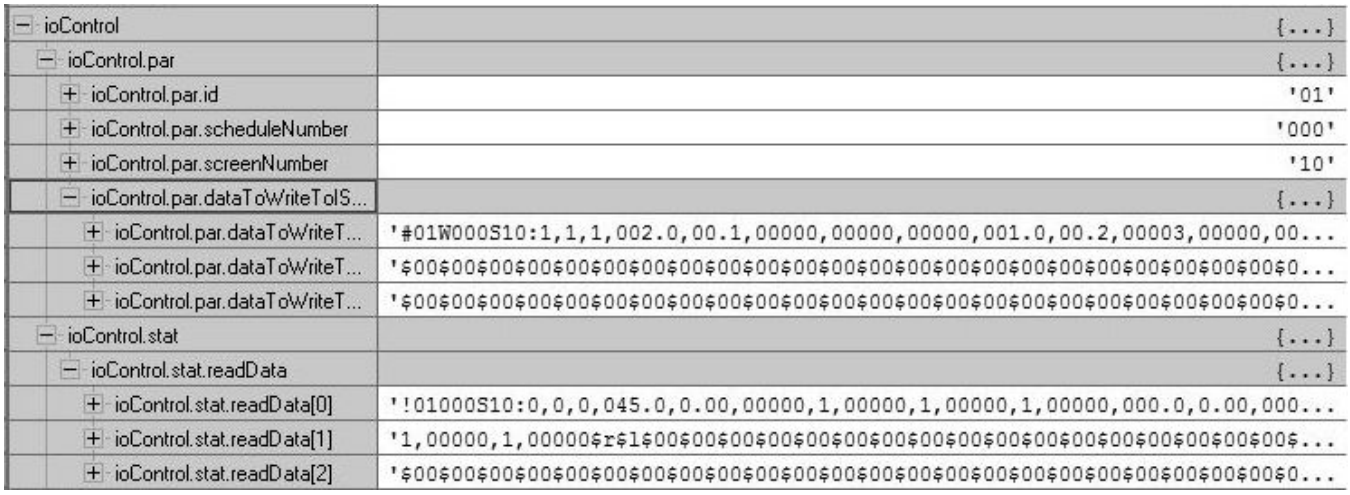
- Select the [Save] button to save the iInverterType controller tag value.

Section V. Digital/Analog I/O's and Weld Data Controls

When online with the CPU in RSLogix 5000, the IS-800CA / 1400CA digital and analog inputs / outputs and screen data can be accessed and controlled through the Controller Tags. The controllable input and output tags of IS-800CA / 1400CA are defined under the "ioControl" group and the serial communication screen data tags are defined under the screen1Data, screen2Data, …. screen9Data and screen10Data groups.

Controller Tag Definitions

IO Parameter Tags



ioControl	{...}
ioControl.par	{...}
ioControl.par.id	'01'
ioControl.par.scheduleNumber	'000'
ioControl.par.screenNumber	'10'
ioControl.par.dataToWriteToIS...	{...}
ioControl.par.dataToWriteT...	'#01W000S10:1,1,1,002.0,00.1,00000,00000,00000,001.0,00.2,00003,00000,00...
ioControl.par.dataToWriteT...	'$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$0...
ioControl.par.dataToWriteT...	'$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$0...
ioControl.stat	{...}
ioControl.stat.readData	{...}
ioControl.stat.readData[0]	'!01000S10:0,0,0,045.0,0.00,00000,1,00000,1,00000,1,00000,000.0,0.00,000...
ioControl.stat.readData[1]	'1,00000,1,00000rl$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$...
ioControl.stat.readData[2]	'$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$0...

ioControl.par.id — Device number tag of the IS-800CA / 1400CA unit to communicate with (hardcoded to 1).

ioControl.par.scheduleNumber — Schedule number tag (1..255) to read / write from / to the IS-800CA.

ioControl.par.screenNumber — Screen number tag (1..10) of the screen data to read /write from / to the IS-800CA.

ioControl.par.dataToWriteToIS800 — ASCII buffer contains the preview of screen data to be written to the IS-800CA. This ASCII buffer gets populated only if the ioControl.com.prepareWriteData tag is set to 1. This ASCII buffer is intended for preview and debugging purposes.

ioControl.stat.readData — ASCII buffer contains the status and request screen data from the IS-800CA.

IO Read / Write Control Tags

ioControl.com	{...}
ioControl.com.writeToIS800	0
ioControl.com.readFromIS800	0
ioControl.com.errorResetComm	0
ioControl.com.prepareWriteData	0
ioControl.com.writeNakError	0

ioControl.com.writeToIS800 Write request flag. Set this flag to 1 when the screen data is populated and ready to be written to the IS-800CA. After the data is written, this flag will get reset back to 0. The PLC program should also monitor for the ioControl.com.writeNakError flag for write failure/error.

ioControl.com.readFromIS800 Read request flag. Set this flag to 1 to request the reading of the schedule/screen data. After the data is read, this flag will get reset back to 0.

ioControl.com.errorResetComm Error reset request flag. Set this flag to 1 to request a reset of the IS-800CA error via serial communication channel. IS-800CA error can also be reset via the IS-800CA digital input bit (refer to the digital input definition below). After the error reset command is written, this flag will get reset back to 0.

ioControl.com.prepareWriteData This tag is to request the screen data be written to the ASCII tag ioControl.par.dataToWriteToIS800 for preview and debugging purposes.

ioControl.com.writeNakError Flag which indicates when there is a screen data write failure to IS-800CA.

Digital Output Tags

The digital output tags are inputs into the IS-800CA / 1400CA Inverter Power Supply

ioControl.do	{...}
ioControl.do.schedule1DO1_1	0
ioControl.do.schedule2DO2_1	0
ioControl.do.schedule4DO3_1	0
ioControl.do.schedule8DO4_1	0
ioControl.do.schedule16DO5_1	0
ioControl.do.schedule32DO6_1	0
ioControl.do.schedule64DO7_1	0
ioControl.do.schedule128DO8_1	0
ioControl.do.we1StopParityDO9_1	0
ioControl.do.we2StopWeldCountDO10_1	0
ioControl.do.stage1DO11_1	0
ioControl.do.stage2DO12_1	0
ioControl.do.weldOnOffDO1_2	0
ioControl.do.errorResetDO2_2	0
ioControl.do.stepResetDO3_2	0
ioControl.do.we3StopCountResetDO4_2	0
ioControl.do.backStepDO5_2	0
ioControl.do.stepModeDO6_2	0
ioControl.do.retract1DO7_2	0
ioControl.do.retract1DO8_2	0

These controller tags contain the mask bits to control the IS-800CA / 1400CA digital inputs. The PLC program is responsible for setting and clearing the bit tag since it doesn't self-clear like the request flag tags.

For example; to select schedule number 5 via digital inputs, ioControl.do.schdule1DO1_1 and ioControl.do.schdule4DO3_1 must be set to 1.

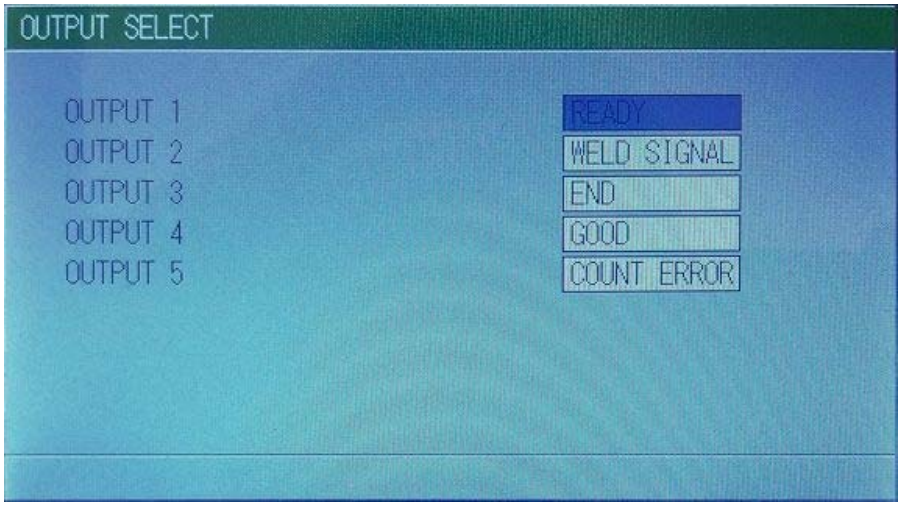
ioControl.do.schedule1DO1_1	Digital bit to select schedule 1 masking bit.
ioControl.do.schedule2DO2_1	Digital bit to select schedule 2 masking bit.
ioControl.do.schedule4DO3_1	Digital bit to select schedule 4 masking bit.
ioControl.do.schedule8DO4_1	Digital bit to select schedule 8 masking bit.
ioControl.do.schedule16DO5_1	Digital bit to select schedule 16 masking bit.
ioControl.do.schedule32DO6_1	Digital bit to select schedule 32 masking bit.
ioControl.do.schedule64DO7_1	Digital bit to select schedule 64 masking bit.
ioControl.do.schedule128DO8_1	Digital bit to select schedule 128 masking bit.
ioControl.do.we1StopParityDO9_1	Digital bit to set the weld 1 stop parity flag.
ioControl.do.we2StopWeldCountDO10_1	Digital bit to set the weld 2 Stop Weld Count flag.
ioControl.do.stage1DO11_1	Digital bit to set weld head stage 1 control.
ioControl.do.stage2DO12_1	Digital bit to set weld head stage 2 control.
ioControl.do.weldOnOffDO1_2	Digital bit to set the weld On/Off control flag.
ioControl.do.errorResetDO2_2	Digital bit to set the digital error reset request..
ioControl.do.stepResetDO3_2	Digital bit to set the step reset flag.
ioControl.do.we3StopCountResetDO4_2	Digital bit to set the weld 3 Stop Count Reset flag.
ioControl.do.backStepDO5_2	Digital bit to set the back step flag.
ioControl.do.stepModeDO6_2	Digital bit to set the step mode flag.
ioControl.do.retract1DO7_2	Digital bit to set the retract 1 flag.
ioControl.do.retract1DO8_2	Digital bit to set the retract 2 flag.

Digital Input Tags

The digital input tags are outputs from IS-800CA / 1400CA Inverter Power Supply. These digital input tags are read-only and for monitoring the digital output status of the IS-800CA / 1400CA Inverter Power Supply.

ioControl.di	{...}
ioControl.di.ng1OutErrorDI1	0
ioControl.di.ng2OutCautionDI2	0
ioControl.di.out1DI3	0
ioControl.di.out2DI4	0
ioControl.di.out3DI5	0
ioControl.di.out4DI6	0
ioControl.di.out5DI7	0
ioControl.di.contactorDI8	0

These controller tags contain the IS-800CA / 1400CA digital outputs. These tags are read only tag from the IS-800CA / 1400CA digital outputs. The ioControl.di.out1 …. ioControl.di.out5 contain the assigned outputs from the Output Select Menu on the MA-660A pendant.



ioControl.di.ng1OutErrorDI1 No good weld output 1 error.

ioControl.di.ng2OutCautionDI2 No good weld output 2 caution

ioControl.di.out1DI3 Digital output 1 from the Output Select menu.

ioControl.di.out2DI4 Digital output 2 from the Output Select menu

ioControl.di.out3DI5 Digital output 3 from the Output Select menu

ioControl.di.out4DI6 Digital output 4 from the Output Select menu

ioControl.di.out5DI7 Digital output 5 from the Output Select menu

Analog Input / Output Tags

ioControl	{...}
ioControl.par	{...}
ioControl.stat	{...}
ioControl.com	{...}
ioControl.di	{...}
ioControl.do	{...}
ioControl.ai	{...}
ioControl.ai.analogIn1AI1	32767
ioControl.ai.analogIn2AI2	32767
ioControl.ai.analogIn3AI3	0
ioControl.ai.analogIn4AI4	0
ioControl.ao	{...}
ioControl.ao.analogOGOut1A01	0
ioControl.ao.analogOGOut2A02	0

ioControl.ai.analogIn1AI1 IS-800CA / 1400CA analog output 1. Output voltage can be +/- 10 volt.

ioControl.ai.analogIn2AI2 IS-800CA / 1400CA analog output 2. Output voltage can be +/- 10 volt.

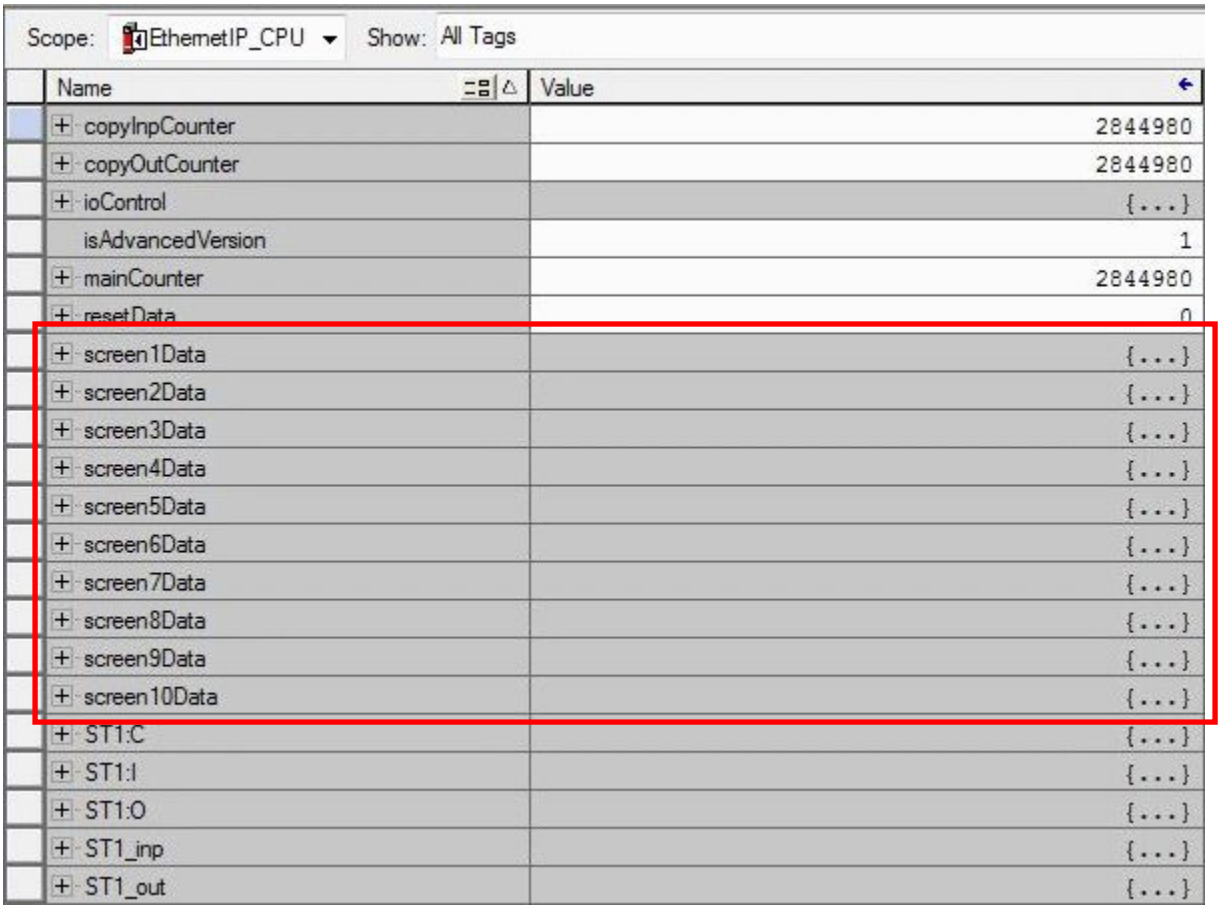
ioControl.ai.analogIn3AI3 IS-800CA / 1400CA analog output 3. Output voltage can be +/- 10 volt.

ioControl.ai.analogIn4AI4 IS-800CA / 1400CA analog output 4. Output voltage can be +/- 10 volt.

ioControl.ao.analogOGOut1A01 Analog input 1 to IS-800CA / 1400CA ±10 V or [0 to 20 mA] / [4 to 20 mA]

ioControl.ao.analogOGOut2A02 Analog input 2 to IS-800CA / 1400CA ±10 V or [0 to 20 mA] / [4 to 20 mA]

Screen Data Tags

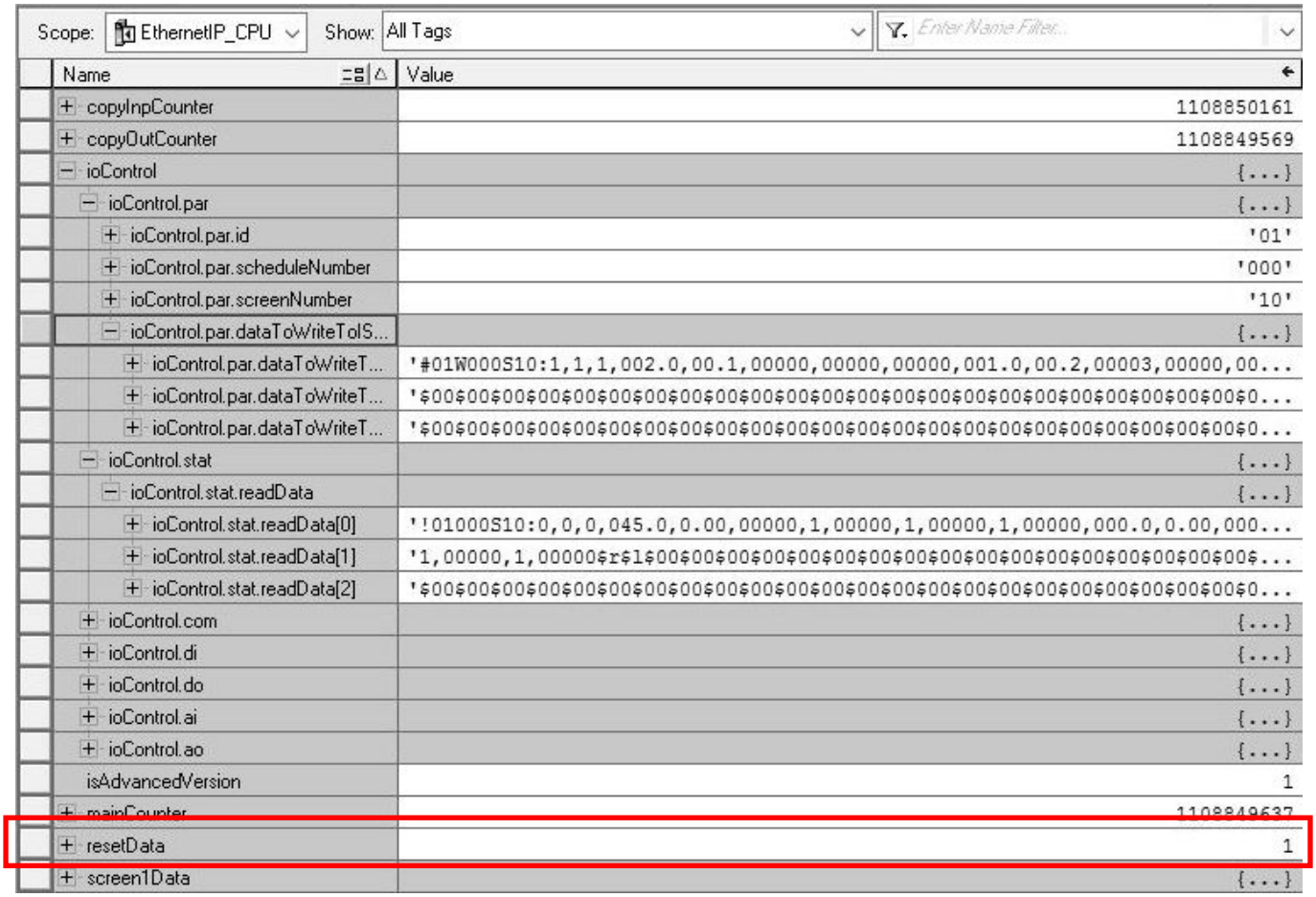


The PLC program can also request screen data for each of the 10 screens. Refer to the example in the *Screen Data and Weld Control* section below for steps to request screen data and write/update the screen data via the controller screen data tags.

Screen Data and Weld Control

To read and write the weld screen data and/or weld schedule data, refer to the next two sections for the steps and tags required to populate the read request and the write update.

It is recommended the PLC program initialize/reset the data on PLC program startup before performing a read and write request of the serial data. To reset/initialize the data, the PLC program must set the controller tag **resetData** = 0 to initiate a reset request. Once the PLC data gets initialized/reset, the 'resetData' will automatically toggle back to 1



Reading of Screen Data from the IS-800CA / 1400CA

To read screen data, the user must first specify the screen number and schedule number to read with the read request flag set to 1.

For example, to read screen data #1 from schedule #1, user must populate the controller schedule, screen number tags below with these requested values and set the read request flag to 1.

ioControl.par.id = '01' (this is always hardcode = 1 since there is only device #1 of IS-800CA / 1400CA)
ioControl.par.scheduleNumber = '001'
ioControl.par.screenNumber = '01'
ioControl.com.readFromIS800 = 1

Once the screen data is successfully read, the 'ioControl.com.readFromIS800' read request tag will be reset back to 0. The data for screen 1, schedule 1 will be populated into each field individually

− screen1Data	{...}
− screen1Data.par1_weld1Control...	{...}
+ screen1Data.par1_weld1Contr...	'0'
− screen1Data.par2_weld2Control...	{...}
+ screen1Data.par2_weld2Contr...	'0'
− screen1Data.par3_weld3Control...	{...}
+ screen1Data.par3_weld3Contr...	'0'
− screen1Data.par4_unitTime	{...}
+ screen1Data.par4_unitTime[0]	'm'
+ screen1Data.par5_squeezeDelay...	'1137'
+ screen1Data.par6_squeezeTime	'0000'
+ screen1Data.par7_upslope1Time	'000'
+ screen1Data.par8_weld1Time	'000'
+ screen1Data.par9_downslope1Ti...	'000'
+ screen1Data.par10_cool1Time	'0000'
+ screen1Data.par11_upslope2Time	'000'
+ screen1Data.par12_weld2Time	'000'
+ screen1Data.par13_downslope2...	'000'
+ screen1Data.par14_cool2Time	'0000'
+ screen1Data.par15_upslope3Time	'000'
+ screen1Data.par16_weld3Time	'000'
+ screen1Data.par17_downslope3...	'000'
+ screen1Data.par18_holdTime	'00000'
+ screen1Data.par19_offTime	'4500'
+ screen1Data.par20_currentRange	{...}
+ screen1Data.par21_UF1	'002.0'
+ screen1Data.par22_Heat1	'002.0'
+ screen1Data.par23_DL1	'002.0'
+ screen1Data.par24_UF2	'002.0'
+ screen1Data.par25_Heat2	'002.0'
+ screen1Data.par26_DL2	'002.0'
+ screen1Data.par27_UF3	'002.0'
+ screen1Data.par28_Heat3	'002.0'
+ screen1Data.par29_DL3	'002.0'
+ screen1Data.par30_pulsationWE1	'01'
+ screen1Data.par31_Interval1	'450'
+ screen1Data.par32_pulsationWE2	'01'
+ screen1Data.par33_Interval2	'000'
+ screen1Data.par34_pulsationWE3	'01'
+ screen1Data.par35_Interval3	'000'
+ screen1Data.par36_weldTransFreq	'1000'

Writing Screen Data to the IS-800CA / 1400CA

To update the screen data, user must first populate every individual screen data tag with the validated data value. User may also perform a screen data read request and then modify / update only the value of the tag that the user wants to change.

For example, to update the data tag 'screen1Data.par19_offTime' value from '4500' to '5000', user must have these tags populated:

ioControl.par.id = '01'	This is always hardcode = 1 since there is only device #1 of IS-800CA / 1400CA
ioControl.par.scheduleNumber = '001'	
ioControl.par.screenNumber = '01'	
screen1Data.par19_offTime = '5000'	Update the tag data with new data value
⋮ ⋮	⋮ ⋮
Screen1Data.parXXXX = XXXXX	Update the rest of the tags with new data value
ioControl.com.prepareWriteData = '1'	Optional if you only want to populate the ioControl.par.dataToWriteToIS800 ascii buffer for preview and debugging purpose.

and finally set the write request flag to 1 to write screen data to IS-800CA / 1400CA:

ioControl.com.writeToIS800 = 1

Once the screen data is written successfully, the 'ioControl.com.writeToIS800' write request flag will be reset back to 0. Make sure to monitor for the 'ioControl.com.writeNakError' status tag for any failure if value > 0.

Weld Control via Digital Input Tags

To perform a weld via the IS-800CA / 1400CA digital inputs, the machine builder PLC can program the controller digital input tags to control the weld process.

For example, to select the weld schedule number 2 and command the weld, the PLC program must set these tags as:

ioControl.do.weldOnOffDO3_2 = 1	Must turn on the Weld ON/OFF to ON
ioControl.do.schdule2DO2_1 = 1	Set the weld schedule 2 masking bit

Is the System READY? Monitoring for the digital output ioControl.di.out1DI3 > 0 ?
Note: the System READY is mapped to the digital output 1 on the pendant OUTPUT SELECT menu.

ioControl.do.stage1DO11_1 = 1	Turn on the weld head stage 1 control
ioControl.do.stage2DO12_1 = 1	Turn on the weld head stage 2 control
ioControl.do.stage1DO11_1 = 0	Turn off the weld head stage 1 control
ioControl.do.stage2DO12_1 = 0	Turn off the weld head stage 2 control

Note: The requirement to turn ON/OFF both Stage 1 and Stage 2 is depending on the weld configurations. A weld can also be controlled with only having a weld head stage 2 ON/OFF

Section VI. Weld Schedule Controller Software Application

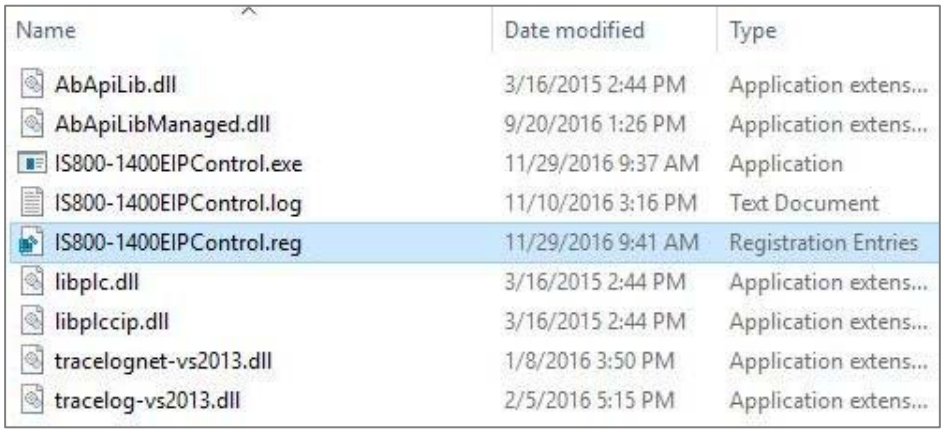
Besides controlling the IS-800CA / 1400CA inverter power supply via a supplied MA-660A pendant, an IS-800CA / 1400CA that has built-in EtherNet/IP™ connectivity can also be controlled with the "IS-800CA / 1400CA Weld Controller Windows Software" Application. The "IS-800CA / 1400CA Weld Controller Windows Software" Application allows the user to control the IS-800CA / 1400CA weld screen data and weld schedules via the Allen Bradley® PLC controller tags by using the EtherNet/IP™ communication protocol. To communicate, the user would need to configure the IS-800CA / 1400CA Weld Controller Application with the Allen Bradley® PLC IP address that it needs to connect and communicate with.

Communication Setup

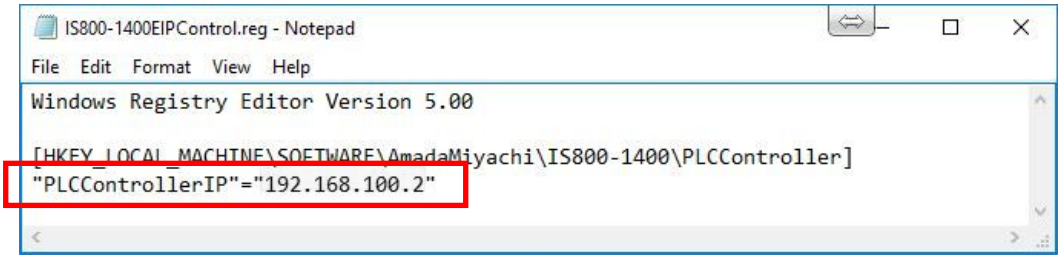
By default the IS-800CA / 1400CA Weld Controller Application is configured to communicate with Allen Bradley® PLC IP address '192.168.100.2'.

To change to a different Allen Bradley® PLC IP address, for example with IP address '10.0.0.2', from the *\IS_Series_AB_EthernetIP\Windows_EthernetIP_WeldControl* folder,

- Select the file **IS800-IS1400EIPControl.reg**

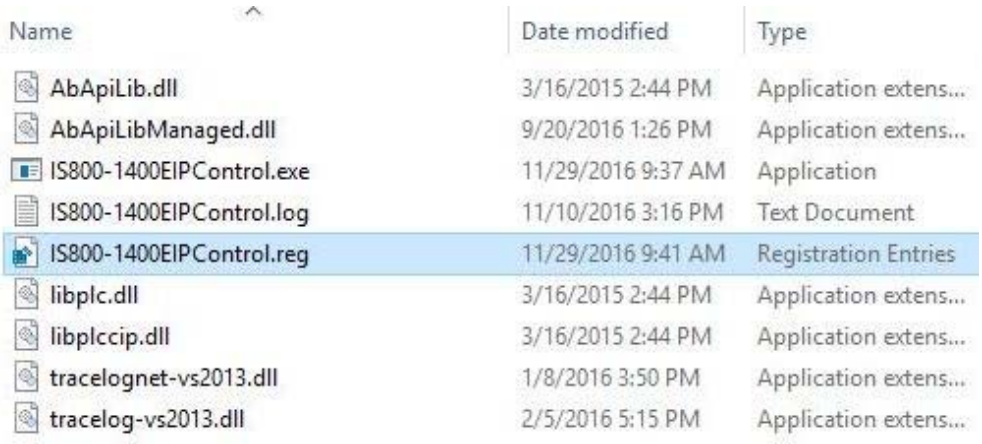


- Perform a right-mouse select.
- When the pop-up menu appears, choose the *Edit* option.
- The "IS800-IS1400EIPControl.reg" file will open in notepad for editing. Another option is to open a new notepad session, then drag and drop this "IS800-IS1400EIPControl.reg" file into it.

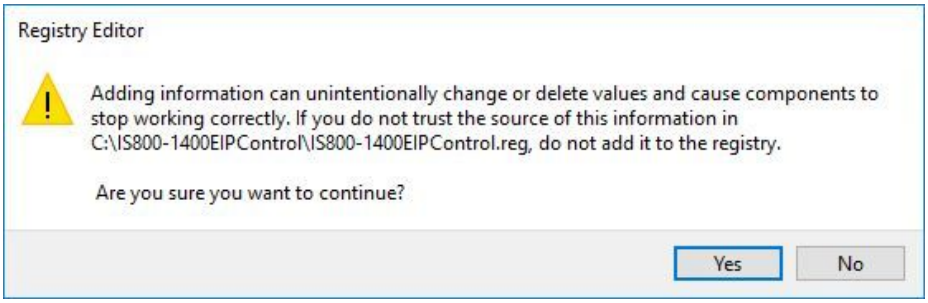


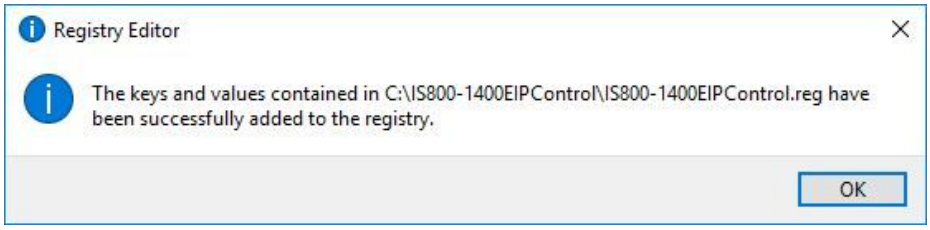
- Now change the IP Address as shown above to “10.0.0.2”.

- Save and close this notepad file when completed.
- From the *\IS_Series_AB_EthernetIP\Windows_EthernetIP_WeldControl* folder, select the file “IS800-IS1400EIPControl.reg”
- Double-click on this file to open it.

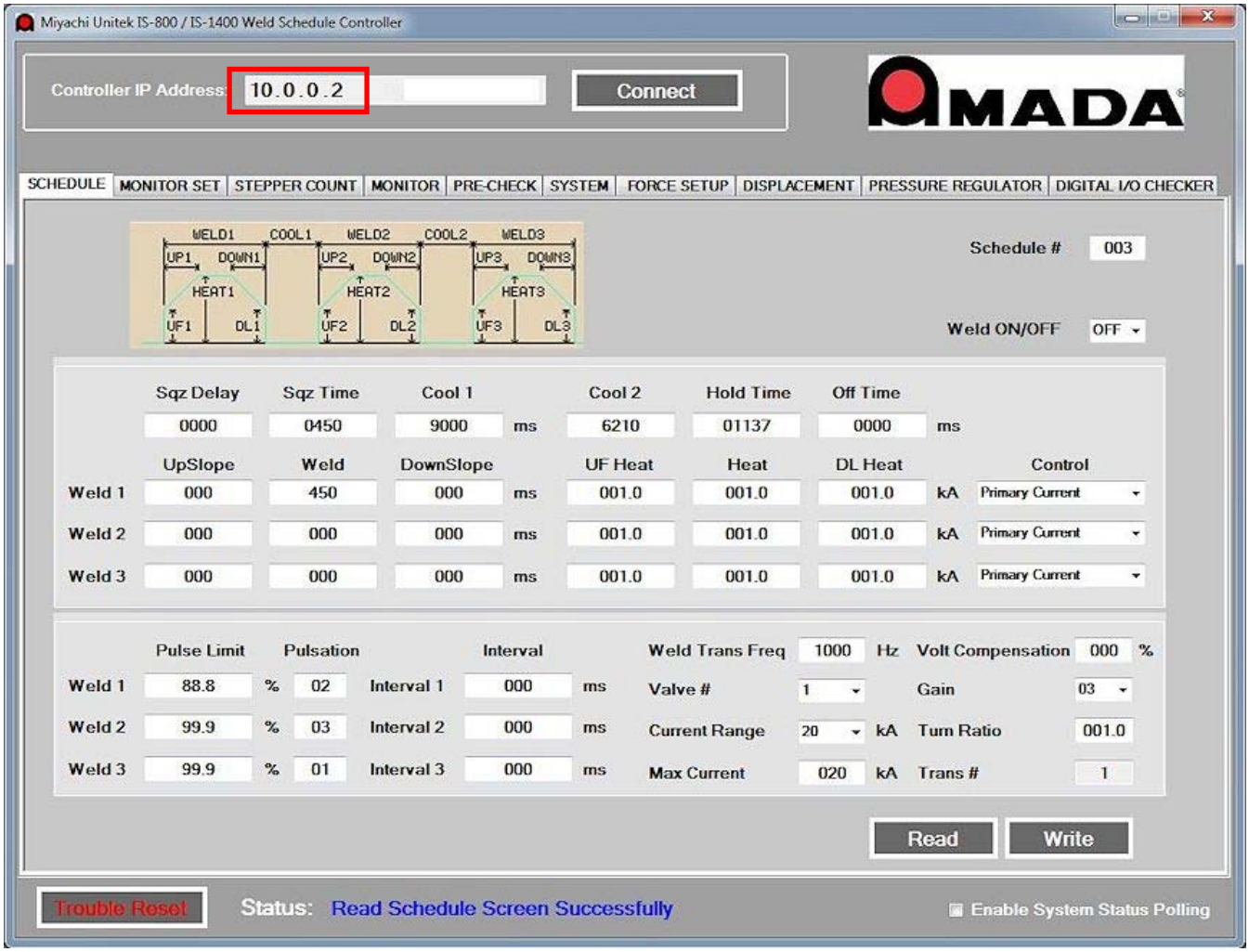


- When the popup confirmation dialog window displays, select [YES] to continue and then select [OK] to accept the change.





- Make sure that the Allen Bradley® PLC is online and running in remote RUN mode. From the *\IS_Series_AB_EthernetIP\Windows_EthernetIP_WeldControl* folder, double-click on the "IS800-IS1400EIPControl.exe" to start the Welder Controller Application. The Controller IP Address field should now show the "10.0.0.2" address.

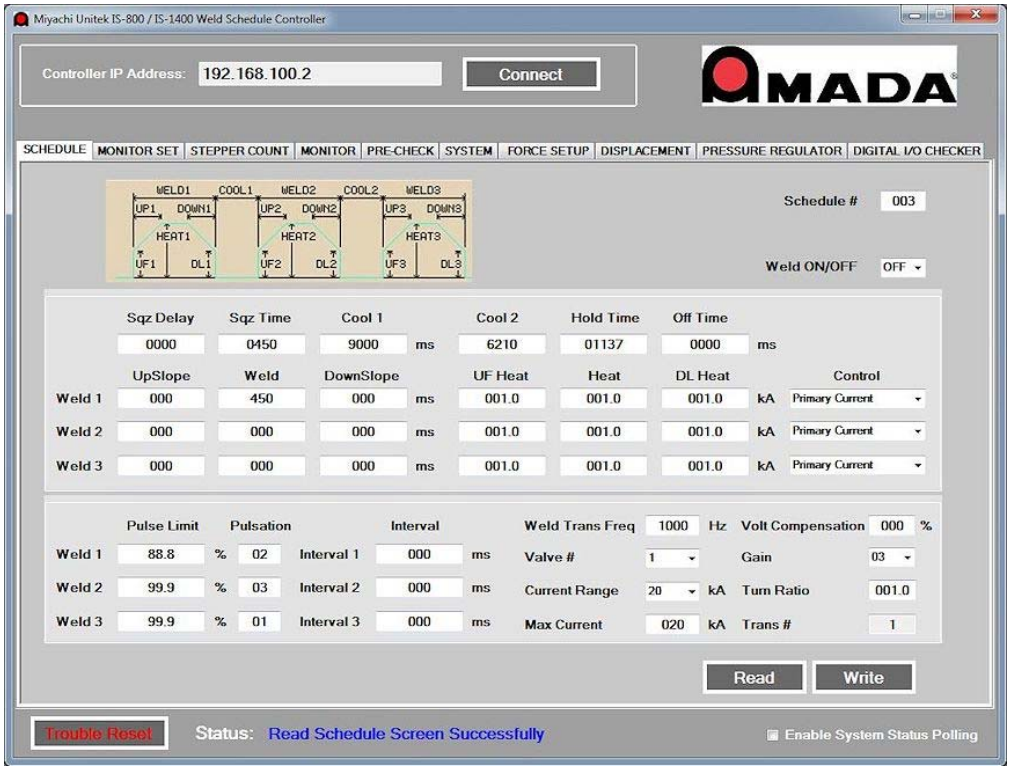


IS-800CA / 1400CA Weld Schedule Controller Screens

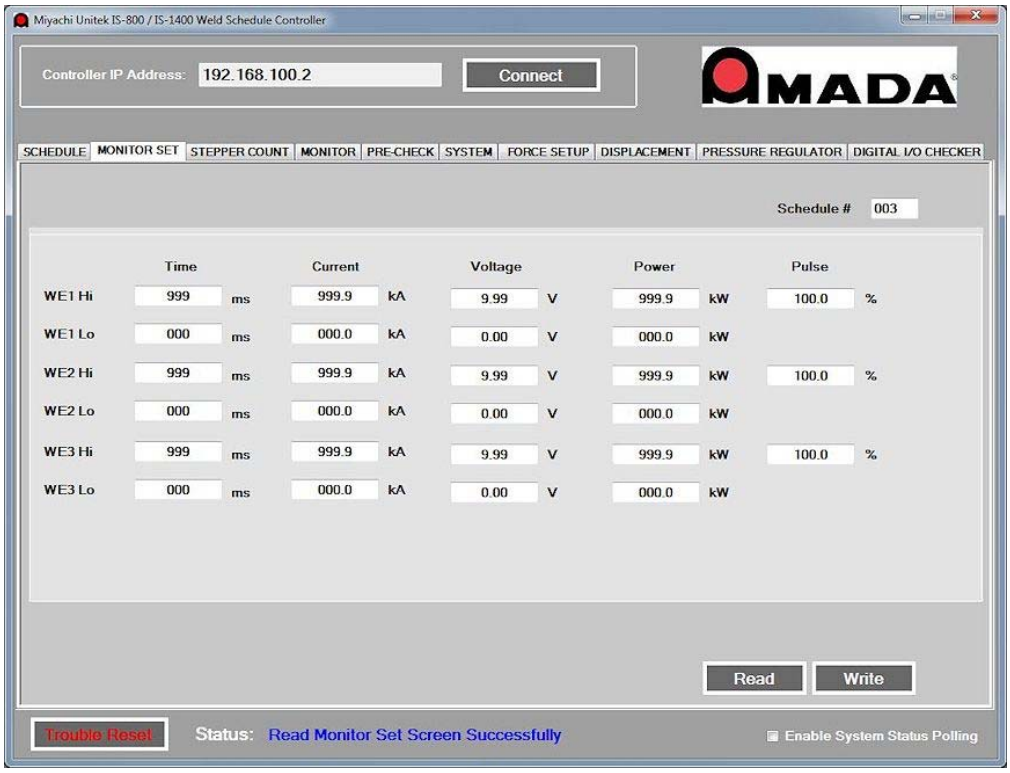
There are 10 different controlled screens with data similar to the screens on the MA-660A pendant. To access the weld schedule for each screen on the IS-800CA / 1400CA, the user must populate the Schedule # field with the schedule number and select the [Read] button. Likewise, to write the weld schedule to each screen on the IS-800CA / 1400CA, select the [Write] button to update the screen data.

To continuously poll the IS-800CA / 1400CA system error status, select the "Enable System Status Polling" checkbox to enable polling. If the Allen Bradley® PLC is programmed to control the weld with rapid / fast speed welding, it is NOT recommended to enable any status or data polling since the continuous polling time will slow down the PLC program weld response time.

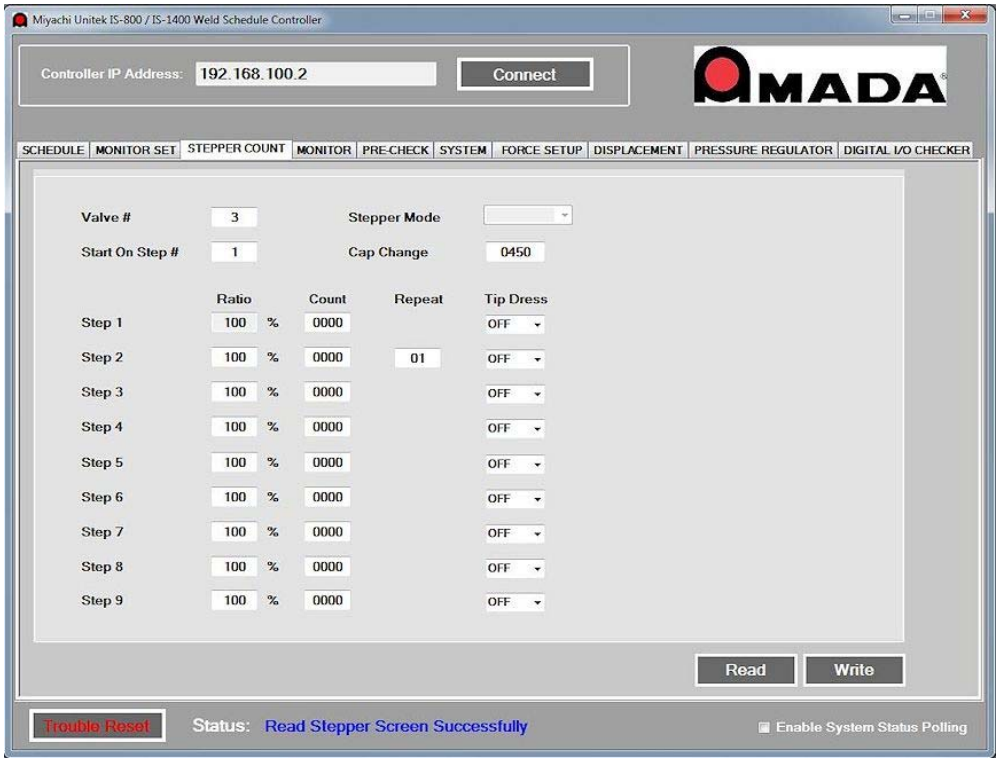
Schedule Screen



Monitor Set Screen



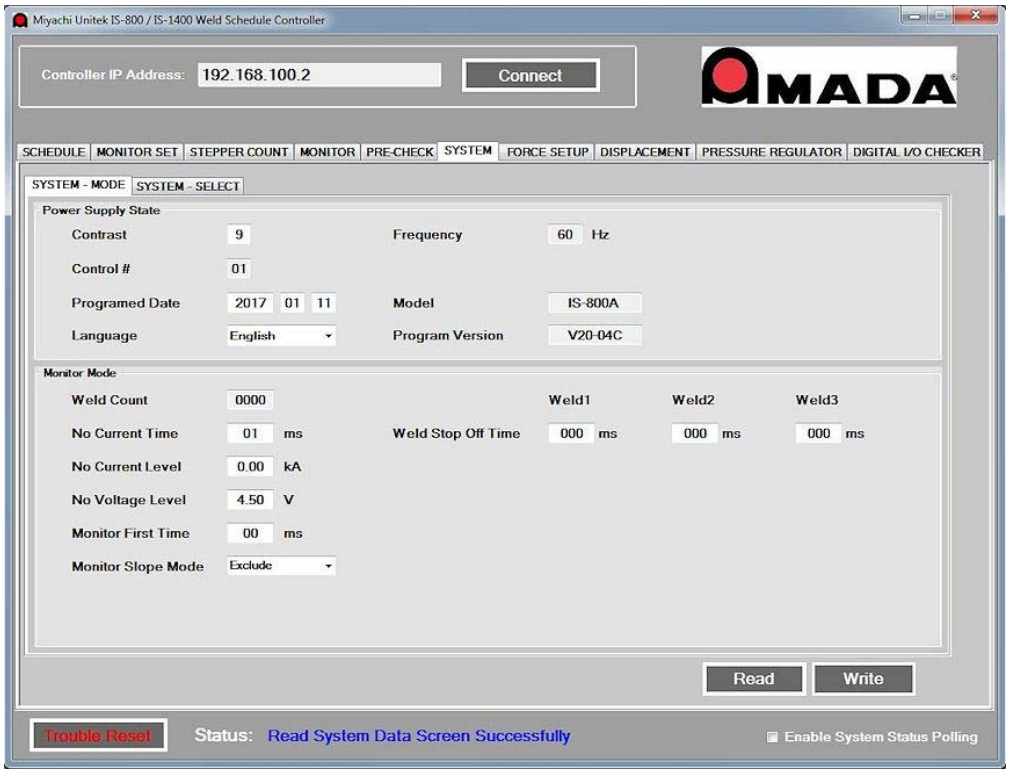
Stepper Count Screen



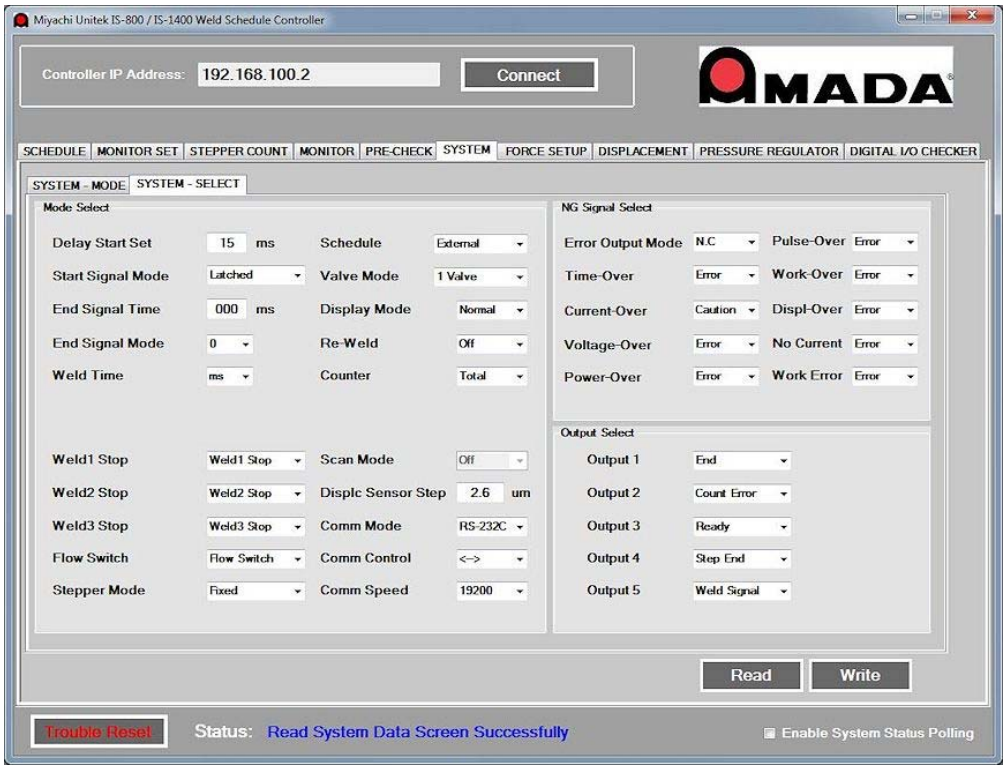
Monitor Screen (READ ONLY)

Pre-Check Screen

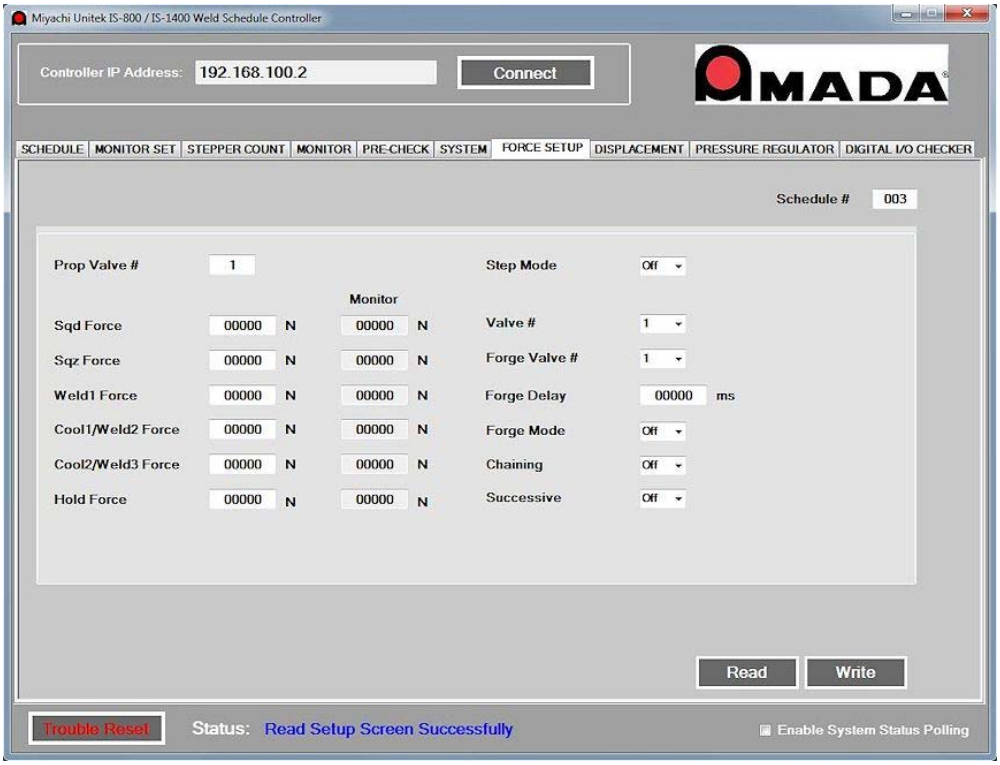
System Mode Screen



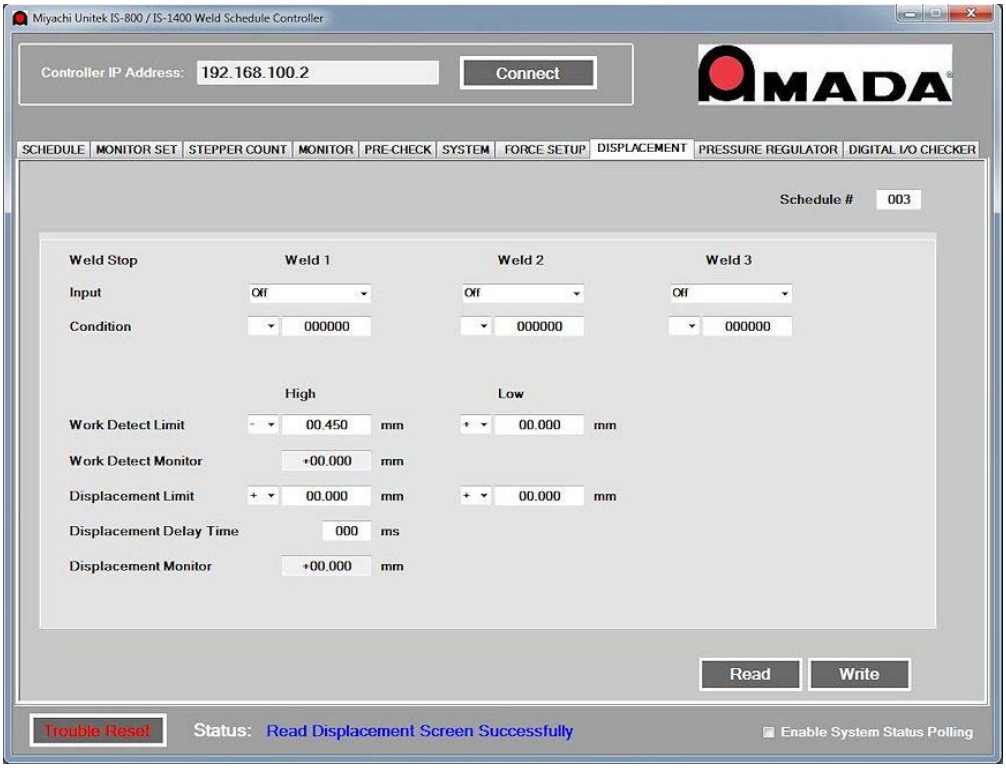
System Select Screen



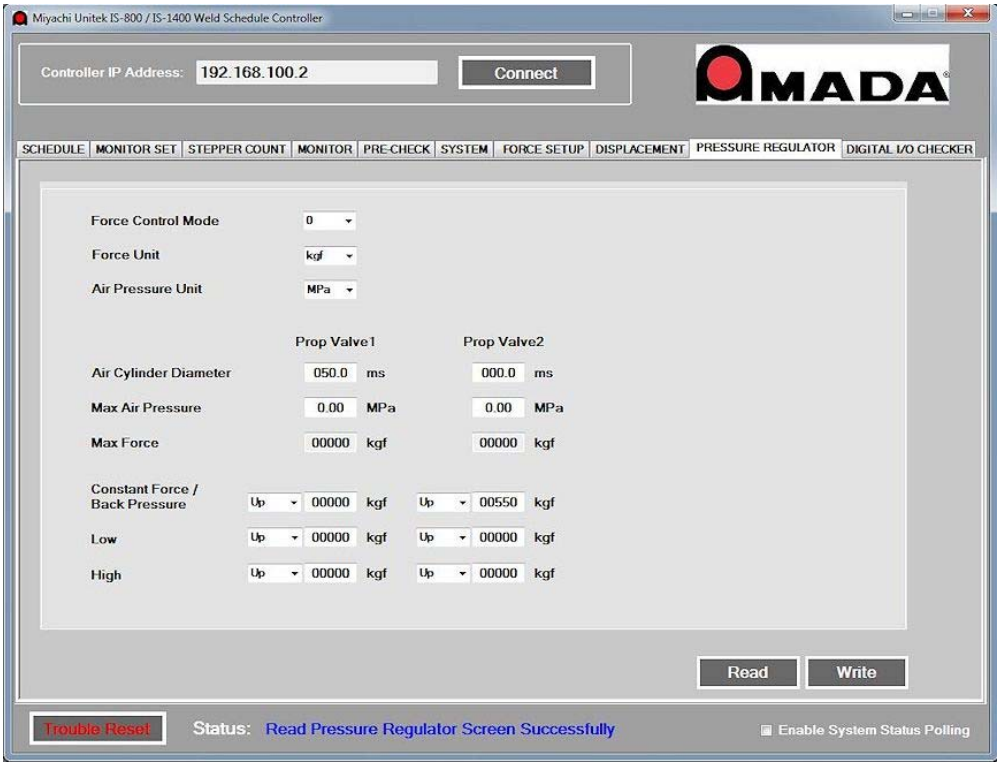
Force Setup Screen



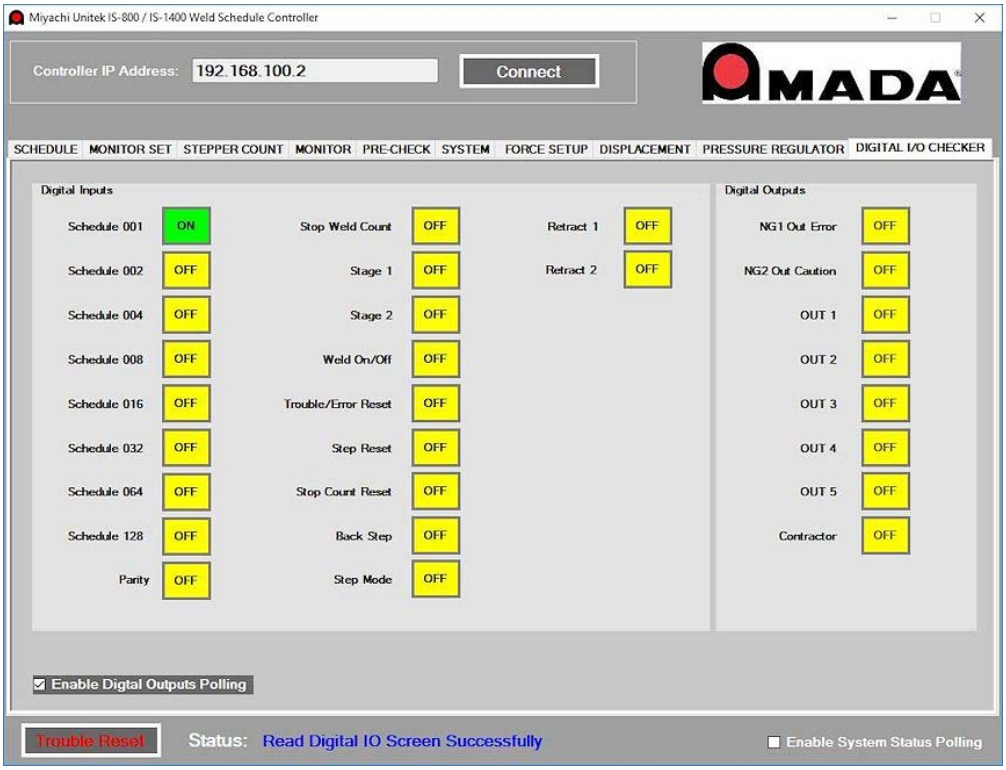
Displacement Screen



Pressure Regulator Screen



Digital I/O Checker Screen



Section VII. Bus Controller Diagnostic Status and Wiring Diagrams

The X20BC0088 bus controller makes it possible to connect the X20 I/O modules to the Allen Bradley® PLC via EtherNet/IP™. Once the bus controller is properly configured and powered up, it should automatically listen for an active (host) scanner connection. When the Allen Bradley® PLC is commanded to go ONLINE in run mode, it will try to connect to the bus controller with the assigned IP address. If the connection between the Allen Bradley® PLC and bus controller is established, the LED status indicators on the X20BC0088 should display as follows:

- Mod Status – Green and stays ON
- Net Status – Green and stays ON
- L/A IF1 – Green and continuously blinks

Or of the bus controller is connected via L/A IF2, then:

- L/A IF2 – Green and continuously blinks

If the Mod status or Net Status LED indicator shows anything other than the Green/On, the bus controller either has not been properly configured or there is some communication issue. Refer to the X20BC0088 LED Status Indicator section below for the descriptions of each status indicator.

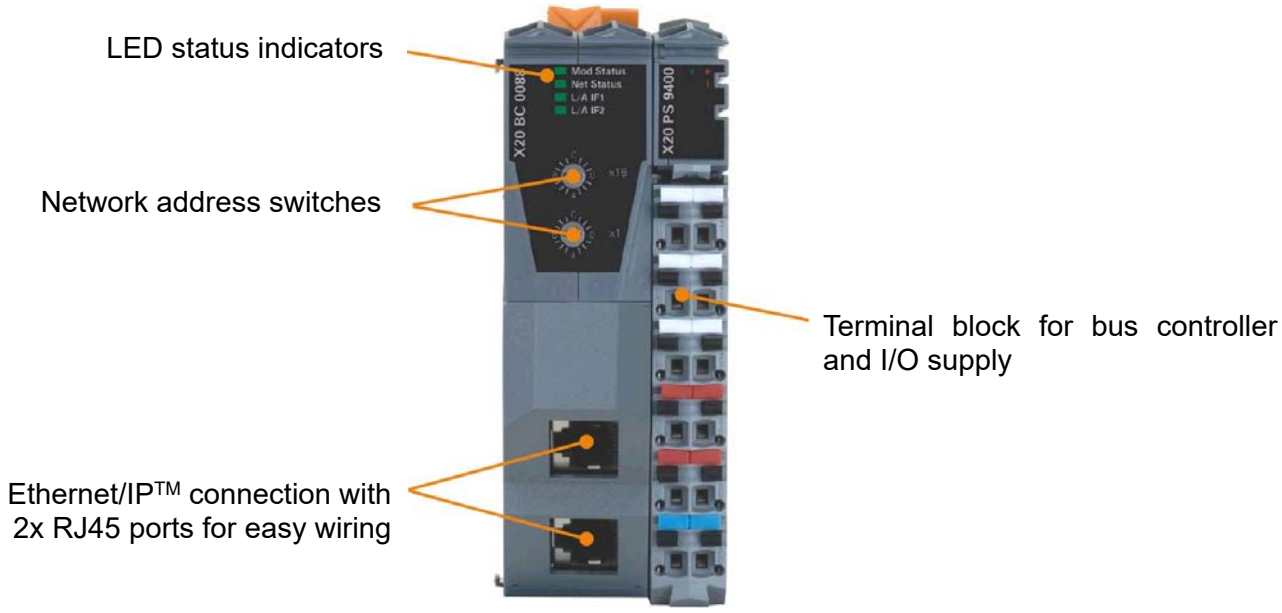
X20BC0088 LED Status Indicators

Figure	LED	Color	Status	Description
	Mod status[1]	Green	On	Indicates that there is at least one client connection
			Blinking	Bus controller not yet configured
			Flickering	HTTP file upload (firmware or configuration file)
		Red	On	Major unrecoverable fault
			Blinking	Major recoverable fault
		Green/Red	Blinking	Initialization / Self-test
	Net status[1]	Green	On	Indicates at least one established active scanner (host) connection
			Blinking	Indicates no established active scanner (host) connection
		Red	Off	Indicates no IP address has been assigned
			On	Indicates an IP address has been used more than once
			Blinking	Indicates a timeout on at least one connection
		Green/Red	Blinking	Initialization / Self-test
	L/A IFx	Green	Blinking	Ethernet activity taking place on the RJ45 port (IF1, IF2) indicated by the respective LED
			On	Indicates an established connection (link), but no communication is taking place.
			Off	Indicates that no physical Ethernet connection exists

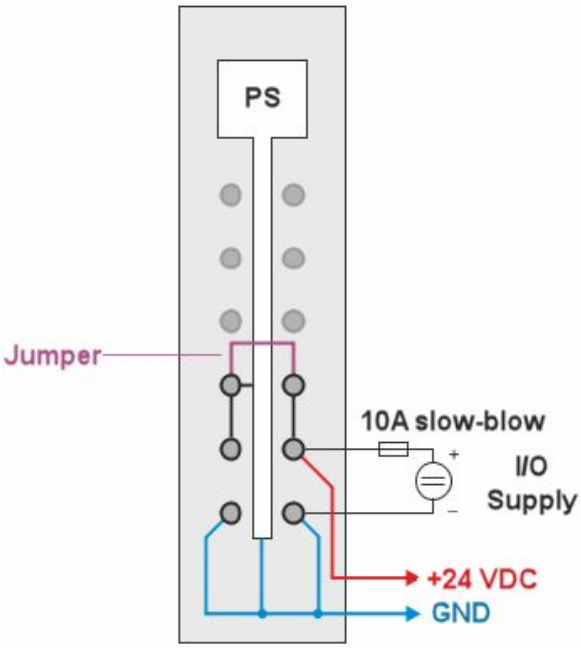
1. The “Mod Status” and “Net Status” LED’s are green/red dual LED’s

Bus Controller I/O Wiring Diagrams

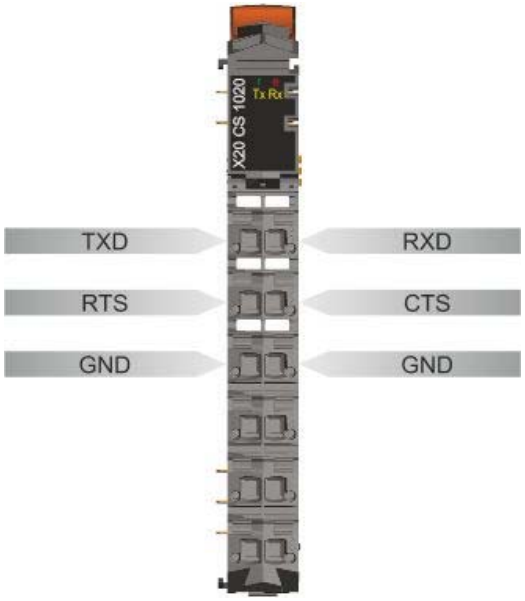
XC20BC0088 – Controller Module



X20 PS9400 – I/O Supply Module

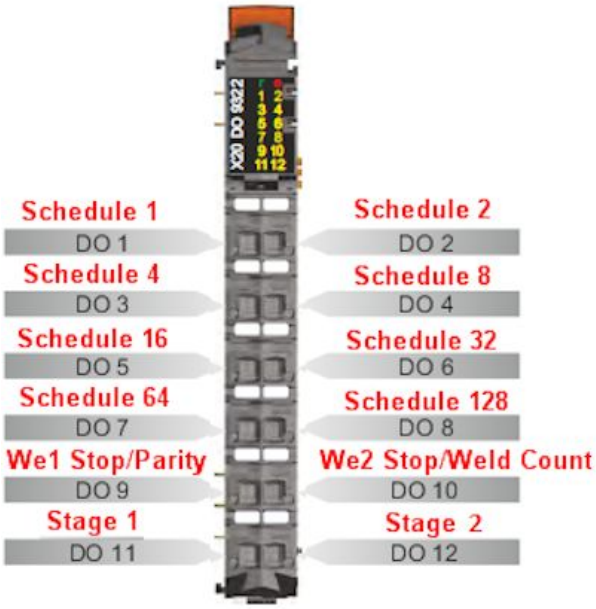


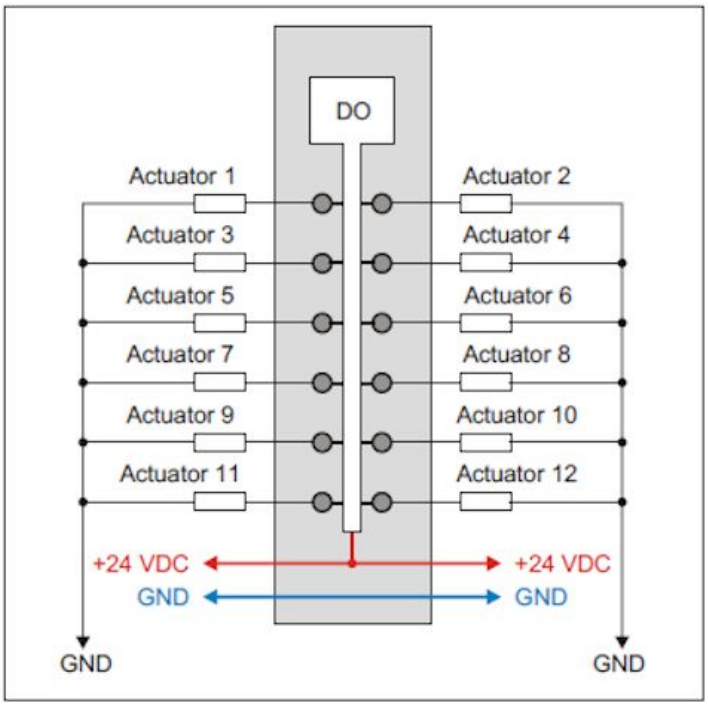
X20 CS1020 – RS-232 Communication Module



X20DO9322 – Digital Output Module 1

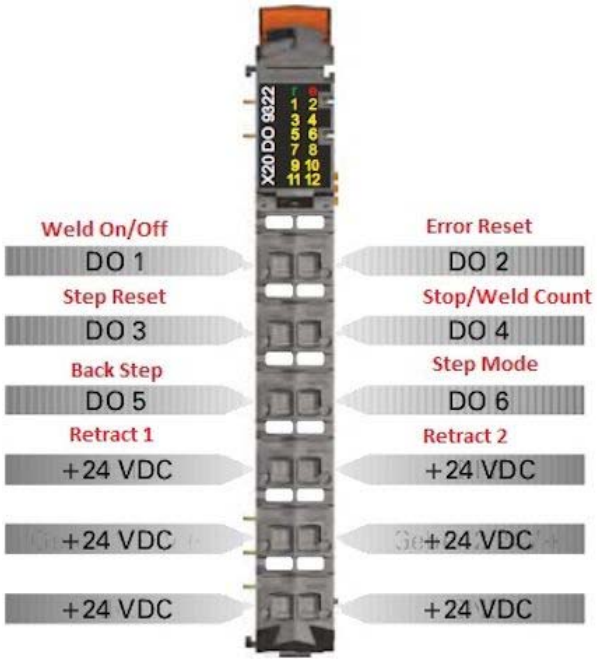
The digital output signals from this module are wired to the digital input pins on the IS-800CA / 1400CA terminal block. Connection example:

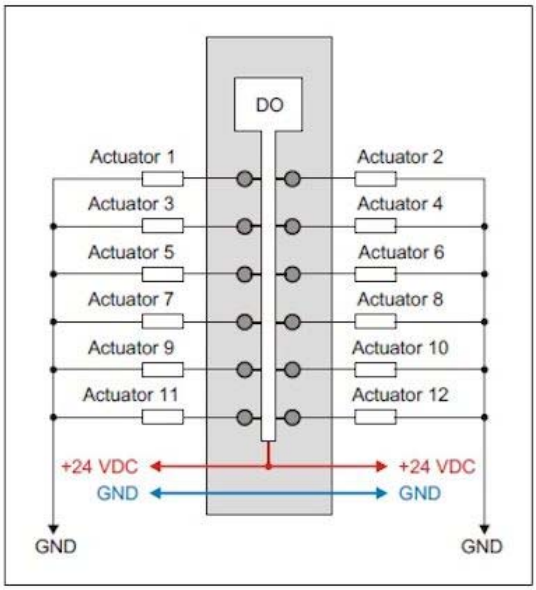




X20DO9322 – Digital Output Module 2

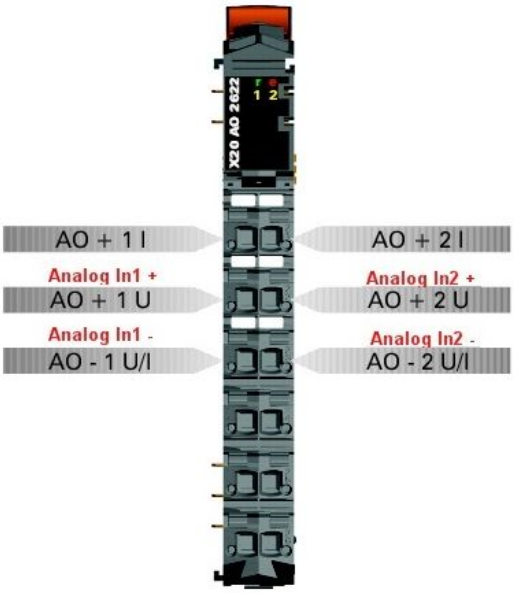
The digital output signals from this module are wired to the digital input pins on the IS-800CA / 1400CA terminal block. Connection example:

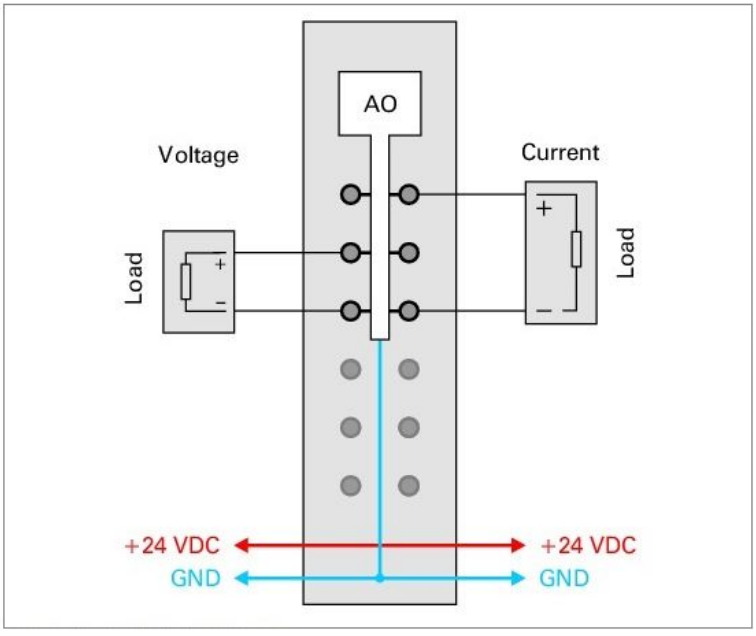




X20AO2622 – Analog Output Module

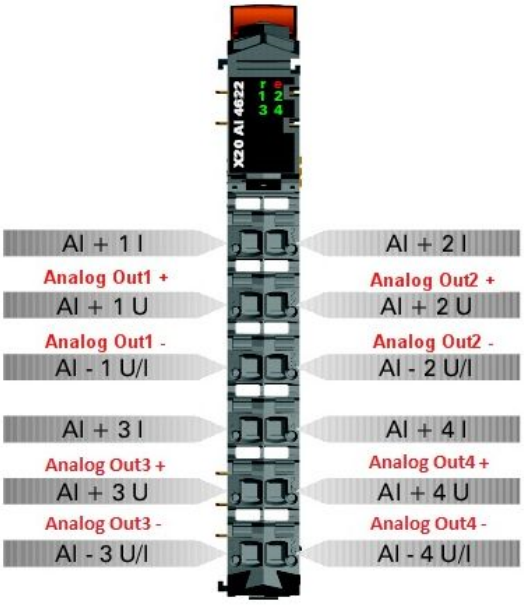
The analog output signals from this module are wired to the analog input pins on the IS-800CA / 1400CA terminal block. Connection example:

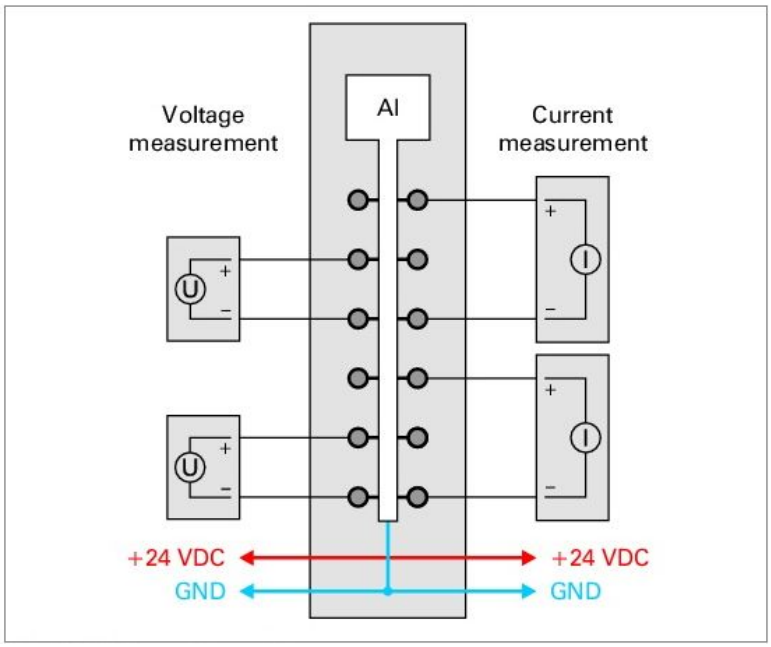




X20AI4622 – Analog Input Module

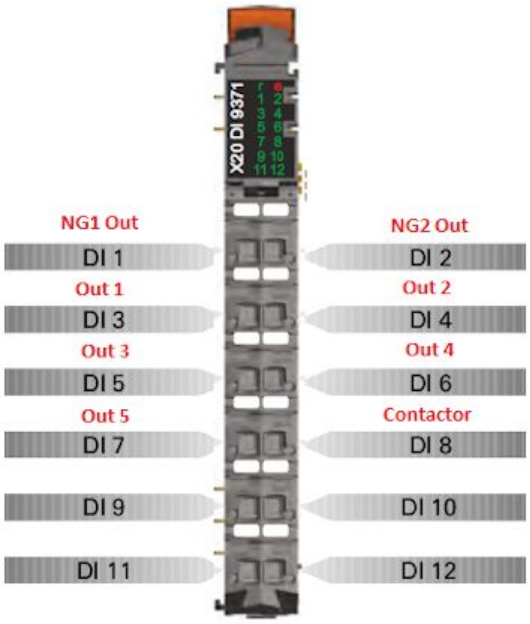
The analog output signals from the IS-800CA / 1400CA terminal block are wired to this module. Connection example:

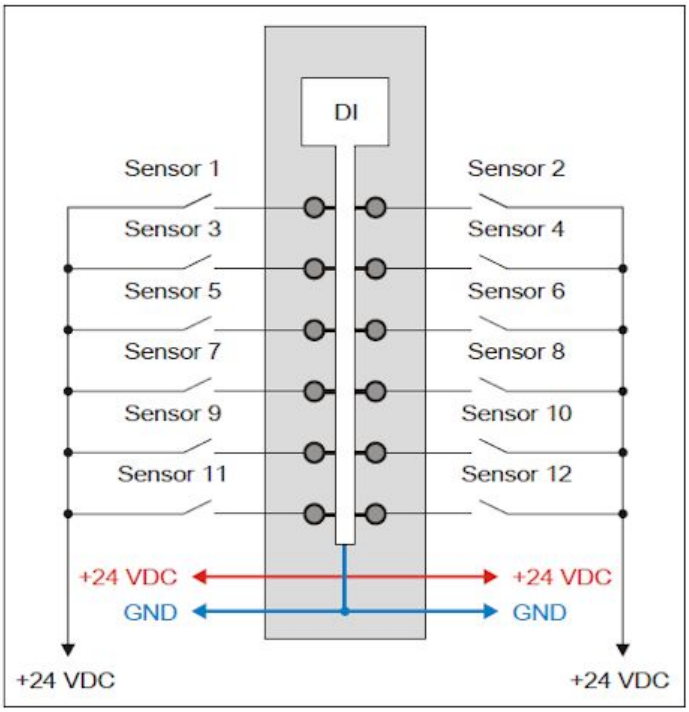




X20DI9371 – Digital Input Module

The digital output signals from the IS-800CA / 1400CA terminal block are wired to this module. Connection example:


X20 DI 9371
NG1 Out
DI 1
NG2 Out
DI 2
Out 1
DI 3
Out 2
DI 4
Out 3
DI 5
Out 4
DI 6
Out 5
DI 7
Contactor
DI 8
DI 9
DI 10
DI 11
DI 12


DI
Sensor 1
Sensor 2
Sensor 3
Sensor 4
Sensor 5
Sensor 6
Sensor 7
Sensor 8
Sensor 9
Sensor 10
Sensor 11
Sensor 12
+24 VDC
+24 VDC
GND
GND
+24 VDC
+24 VDC

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