Publication #: 890015-01-09

BENSHAW
ADVANCED CONTROLS & DRIVES

REDISTART MICRO II
MVRSM12/18 SERIES
1,500 to 7,200 V
With Advanced Fiber Optic Technology
Instruction Manual

The Leader In

Solid State Motor Control

Technology

February 2006
Software # 890010-02-21

Congratulations on the purchase of your new Benshaw Micro II MVRSM Soft Starter.
Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Benshaw does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Do not attempt to install, operate, maintain or inspect the soft starter until you have thoroughly read this manual and related documents carefully and can use the equipment correctly.
Do not use the soft starter until you have a full knowledge of the equipment, safety procedures and instructions.

This instruction manual classifieds safety instruction levels under "WARNING" and "CAUTION".

Electrical Hazard that could result in injury or death.

Caution that could result in damage to the drive.
Highlight marking an important point in the documentation.

Please follow the instructions of both safety levels as they are important to personal safety.

High Voltage

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.
Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

Table of Contents

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1. INTRODUCTION

1.1 INTRODUCTION

Using This manual

Layout

This manual is divided into eight sections. Each section contains topics related to the section. The sections are as follows;

- **Introduction** - Basic RediStart Micro II information.
- **Technical Specifications** - RediStart Micro II specifications.
- **Installation** - Information on installing the RediStart Micro II.
- **Operation** - Information on how the starter operates.
- **Programming** - Programming the RediStart Micro II.
- **Troubleshooting** - Diagnosing RediStart Micro II problems.
- **Drawings** - RediStart Micro II card layout drawings.
- **Parameter List** - List allowing user to record programmed values.

Parameter List

The last chapter of the manual is a parameter list. This list gives the user a place to enter the programmed value for each parameter and also gives the page number where the description of the parameter can be found. This list can be used as a quick reference to find the information on a parameter.

Symbols

There are two symbols used in this manual to highlight important information. The symbols appear as the following;

Electrical hazard that could result in injury or death.

Caution that could result in damage to the starter or motor.
Highlight marking an important point in the documentation.

Benshaw Services

General Information

Benshaw offers its customers the following services:

- Start-up services.
- On-site training services.
- Technical support.
- Detailed documentation.
- Replacement parts.

⌘ **NOTE:** Information about products and services is available by contacting Benshaw.

Start-Up Services

Benshaw technical field support personnel are available to assist customers with the initial start-up of the RediStart Micro II. Information about start-up services and fees are available by contacting Benshaw.

On-Site Training Services

Benshaw technical field support personnel are available to conduct on-site training on RediStart Micro II operations and troubleshooting.

Technical Support

Benshaw technical support personnel are available (at no charge) to answer customer questions and provide technical support over the telephone. For information about contacting technical support personnel, refer to Contacting Benshaw on page 4.

Documentation

Benshaw provides all customers with:

- Operations manual.
- Wiring diagram.

All drawings are produced in AutoCAD© format. The drawings are available on standard CD or via e-mail by contacting Benshaw.

On-Line Documentation

All RediStart Micro II documentation is available on-line at **www.benshaw.com**.

Replacement Parts

Spare and replacement parts can be purchased from Benshaw Technical Support.

Warranty

Benshaw provides a 1 year standard warranty with its starters. A 3 year warranty extension is provided when a Benshaw or Benshaw authorized service technician completes the installation and initial start up. The warranty data sheet starting on page 154 must also be signed and returned. This information is also available by going online to register at www.benshaw.com. The cost of this service is not included in the price of the Benshaw softstarter and will be quoted specifically to each customers needs. All recommended maintenance procedures must be followed throughout the warranty period to ensure validity.

Contacting Benshaw

Contacting Benshaw

Information about Benshaw products and services is available by contacting Benshaw at one of the following offices:

Benshaw Inc. Corporate Headquarters
1659 E. Sutter Road
Glenshaw, PA 15116
United States of America
Phone: (412) 487 8235
Toll Free:(800) 203-2416
Fax: (412) 487 4201

Benshaw Canada Controls Inc.
550 Bright Street
Listowel, Ontario N4W 3W3
Canada
Phone: (519) 291 5112
Toll Free:(877) BEN-SHAW (236-7429)
Fax: (519) 291 2595

Benshaw West
14715 North 78th Way, Suite 600
Scottsdale, AZ 85260
United States of America
Phone: (480) 905 0601
Fax: (480) 905 0757

Technical support for the RediStart Micro II is available at no charge by contacting Benshaw's customer service department at one of the above telephone numbers. A service technician is available Monday through Friday from 8:00 a.m. to 5:00 p.m. EST.

⌘ **NOTE:** An on-call technician is available after normal business hours and on weekends by calling Benshaw and following the recorded instructions.

To help assure prompt and accurate service, please have the following information available when contacting Benshaw:

- Name of company.
- Telephone number where caller can be contacted.
- Fax number of caller.
- Benshaw product name.
- Benshaw model number.
- Benshaw serial number.
- Name of product distributor.
- Approximate date of purchase.
- Voltage of motor attached to Benshaw product.
- FLA of motor attached to Benshaw product.
- A brief description of the application.

Introduction

Introduction

The Benshaw Medium Voltage Starter is a microprocessor controlled solid state reduced voltage starter for three phase induction motors. The starter provides a closed-loop current ramp for smooth stepless motor acceleration. Supplied in a free standing enclosure. It is a fully integrated, programmable, NEMA Class E2, combination solid state starter. This integrated UL listed design includes control and power electronics, bypass and isolation contactors, and fusible load break switch to reduce maintenance and operating costs compared to other starting methods.

Inspection

Upon receipt of the unit, verify that the model number and unit options stated on the shipping container match those stated on the order/purchase form.

Inspect the equipment upon delivery and report any crate or carton damage to the carrier prior ro accepting the delivery. Have this information noted on the freight bill. Benshaw is not responsible for damage incurred in shipping.

Unpacking

Remove all packing material from the unit. Be sure to remove all packing material from lug locations. Also, make sure no packing material blocks the airflow near the fans.

Storage

It is recommended that the unit be stored in its original shipping box/crate until it is to be installed.

The unit should be stored in a location where:

- The ambient temperature is -4.0°F to 140°F (-20°C to 60°C)
- The relative humidity is 0% to 95%, non-condensing
- The environment is dry, clean and non-corrosive
- The unit will not be subjected to high shock or vibration conditions

1.1 INTRODUCTION

Features

General

- Chassis or NEMA 1, 4, 12, or 3R enclosure

Protection (ANSI standard #'s given)

- 86 - Overload lockout
- 49/51 - Electronic motor overload (class 1 to 40)
- 48 - Adjustable up-to-speed timer (off; 0 to 300 seconds)
- 59/27 - Adjustable over/under voltage protection
- 46 - Adjustable line to average current imbalance
- 81 - Adjustable high and low frequency protection
- Single phase protection
- 66 - Adjustable starts per hour (off or 1 to 20 starts)
- Adjustable time between starts (off or 1 to 600 minutes)
- Backspin timer (off or 1 to 200 minutes)
- 51 - Over current detection (Off or 50 to 800%) and time (0.1 to 90.0 sec. in 0.1 sec. intervals)
- 37 - Undercurrent detection (Off or 10 to 100% and time (0.1 to 90.0 sec. in 0.1 sec. intervals)
- 50N/51N - Ground fault detection (Off or 1 to 100 amps) and time (0.1 to 90.0 sec. in 0.1 sec. intervals)
- Over-current, undercurrent, and ground fault can each be set to trip or activate a relay
- 50 - Instantaneous electronic overcurrent trip
- Shorted SCR detection
- 47 - Phase rotation selectable ABC, CBA, or Ins (insensitive)
- 38/49 - Remote Mountable RTD protection package, 8 or 16 RTD inputs (optional)
- PORT (power outage ride through) available with external 120VAC.

Control

- Two programmable current ramp profiles selectable at any time via 120 volt input
- Initial current, maximum current, and ramp time adjustments for each ramp
- Kick Current and time adjustments for each ramp
- TT(TruTorque) / KW(Kilowatt) acceleration and deceleration profiles
- Adjustable deceleration profiles (to eliminate water hammer)
- Local start/stop controls
- Emergency reset capability
- Tachometer ramp control (requires 0-5VDC tachometer feedback signal)

Input/Output and Display

- Plain English operation via back lit LCD display interface
- LCD and LED status and diagnostics (full fault annunciation)
- Programmable metering (amps, volts, frequency, overload, power factor, elapsed time, watts, VARs, watt-hours, VA, current imbalance, ground fault current, RTD temperatures)
- Programmable relay outputs
- Latched fault relay output
- Real time clock
- Time stamped event recorder
- Password protection
- Battery backed-up starter parameters and lockout times

2. TECHNICAL SPECIFICATIONS

2.1 TECHNICAL SPECIFICATIONS

CT Inputs (current transformer inputs)

Conversion	Calibrated RMS, 12 samples per cycle
Range	0.01 to 1.5 × phase CT primary amps set point
Accuracy	±3.5% of phase CT primary amps set point
Frequency	23 to 72Hz
Current Withstand	- 2.0 × CT primary amps set point (CT ratio parameter) - continuous - 10 × CT primary amps set point (CT ratio parameter) - 30 seconds - 55 × CT primary amps set point (CT ratio parameter) - 1 seconds

Voltage Inputs

Conversion	Calibrated RMS, 12 samples per cycle
Range	1000VAC to 9999VAC
Accuracy	±3.5% of full range

Metering

Current	±5%, 0 to 9999Amps
Voltage	±5%, 0 to 9999Volts
Watts	±5%, 0 to 6553kW
Volt-Amps Reactive	±5%, 0 to 6553kVAR
Volt-Amps	±5%, 0 to 6553kVA
WH	±5%, 0 to 6553MWH
PF	±3.5%, -0.01 to +0.01

Real Time Clock

Accuracy	±1 minute per month
Range	1/1/1970 to 1/1/2069

Output Relays

Fault Relay	- SPDT - Form C - 2A, 125VAC, resistive - 1A, 125VAC, 0.4 PF - 2A, 30VDC resistive - 100VA inrush
Output Relay #1 & #2	- SPDT - Form C - 16A, 250VAC resistive - 8A, 250VAC 0.4 PF - 16A, 30VDC resistive - 2000VA inrush

Four Relay Card	- DPDT - Dual Form C - 5A, 250VAC, resistive - 2A, 250VAC, 0.4 PF - 5A, 30VDC, resistive - 500VA inrush
Seven Relay Card	- SPDT - Form C - 8A, 250VAC resistive - 4A, 250VAC 0.4 PF - 8A, 30VDC resistive - 800VA inrush

Control Power

Voltage	120VAC, ±15% 240VAC, ±15% (Optional)
Frequency	50 to 60Hz
Power Consumption	Varies for required control.
Fuse	Time delay control circuit protection fuses.

Storage and Operating Conditions

Storage	-20ºC (-4°F) to +70°C (+158°F) 0% to 95% relative humidity, non-condensing
Operating	0°C (+32°F) to +50°C (+122°F) 0% to 95% relative humidity, non-condensing

DeviceNet (Embedded)

Manual	Available at www.benshaw.com or from your Benshaw sales office.
EDS File	Available at www.benshaw.com or from your Benshaw sales office.
Device Type	Softstart Starter
I/O Slave Messaging	Polling
Baud Rates	- 125K - 250K - 500K
Conformance	Self tested with ODVA (Open DeviceNet Vendor Association) software.

ModBUS (Optional)

Manual	Available at www.benshaw.com or from your Benshaw sales office.
Type	ModBUS RTU
Connections	- RS-232 - RS-485
Baud Rates	- 2400 - 4800 - 9600

2.1 TECHNICAL SPECIFICATIONS

EU Declaration of Conformity

According to the EMC – Directive 89/336/EEC as Amended by 92/31/EEC and 93/68/EEC

Product Category:	Motor Controller
Product Type:	Reduced Voltage Solid State Motor Controller
Model Numbers:	RSM6, RSM7, RSM10, RSM11, RMB6, MVRSM12/18
Manufacturers Name:	Benshaw, Inc.
Manufacturers Address:	1659 East Sutter Road Glenshaw, PA USA 15116

The before mentioned products comply with the following EU directives and Standards:

Safety:	UL 347 Standard for Industrial Control Equipment covering devices for starting, stopping, regulating, controlling, or protecting electric motors with ratings of 1500 volts or more.
EMC:	EN 50081-2 Emissions Radiated/Conducted EN 55011/05.98+A1:1999 EN 50082-2 Immunity/Susceptibility which includes: EN 61000-4-2 Electrostatic Discharge EN 61000-4-3 Radiated RF EN 61000-4-4 Electrical Fast Transient/Burst EN 61000-4-6 Injected Currents

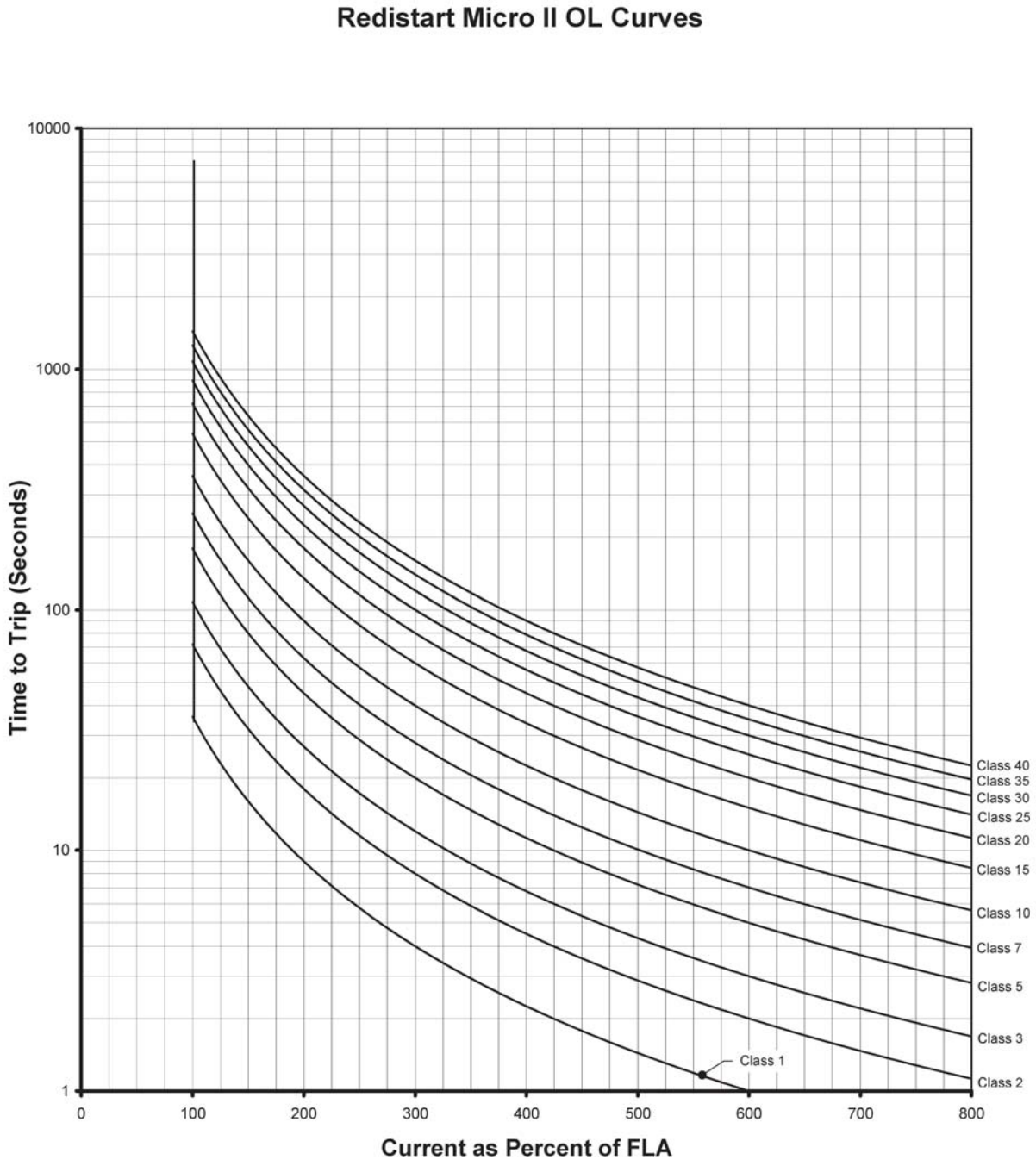
The technical files and other documentation are on file at Benshaw, Inc. and controlled by the Product Engineering Group. Benshaw, Inc. has internal production control systems that ensures compliance between the manufactured products and the technical documentation.

Neil Abrams	Harry Hagerty
Quality Control Manager	Advanced Controls and Drives Manager

Overload Curves

General	The RediStart Micro II comes with forty (40) standard overload curves. The 100% (no trip) point is the motor FLA setting multiplied by the service factor. These curves are shown on the next page. ⌘ **NOTE:** When the overload is greater than 0%, the time to trip will be lowered by this percentage.
Curves	Class 1 to 40 in steps of 1.
Trip Time Accuracy	±2 seconds up to 30 seconds

Overload Curve Chart



RediStart Micro II Computer Card Jumpers

Jumper	Description	Position 1-2 (In - 2-pos. jumper)	Position 2-3 (Out - 2-pos. jumper)	Standard
JPC5	LCD Start Button	Enable	Disable	1-2
JPC7	O/L Reset Auto/Manual	Automatic	Manual	2-3
JPC8	Display Format	Not Installed	Installed	1-2
JPC12	SCR Firing	Pulse	Block	Out
JPC13	LCD Stop Button	Enable	Disable	1-2
JPC19	Fault Reset	Automatic	Manual	2-3

Voltage	JPC17	JPC18	Firmware
2400	2-3	2-3	810010-02-XX
3300	1-2	1-2	810010-02-XX
4160	1-2	2-3	810010-02-XX
4800	2-3	1-2	810010-02-XX
6600	2-3	2-3	810010-07-XX

Computer Card JC11 Header Assignments

Position	Assignment
1-16	Starter equipped with voltage divider card.
2-15	Not used.
3-14	Starter Equipped with MODBUS master card (for RTD module).
4-13	Not used.
5-12	Not used.
6-11	Enables emergency reset.
7-10	Not used.
8-9	Not used.

Notes:

3. INSTALLATION

3.1 INSTALLATION

Site Preparation

General

Before the installation of the RediStart Micro II, the site should be prepared. The customer is responsible for:

- Providing the correct power source.
- Selecting the control mechanism.
- Providing the connection cables and associated hardware.
- Ensuring the installation site meets all environmental specifications for the enclosure NEMA rating.

Connection Cables

The connection cables for the starter must have the correct NEC/C.S.A. current rating for the unit being installed. Depending upon the model, the connection cables can range from a single #14 AWG conductor to four 750 MCM cables.

Site Requirements

The installation site must adhere to the applicable starter NEMA rating. For optimal performance, the installation site must meet the following specifications, unless equipment (such as a heater or air conditioner) was added to the unit for operation outside of these ranges:

- Temperature: 0°C (+32F) to 40°C (+104°F).
- Humidity: 20% to 95% non-condensing.
- Airways: Clearances are provided around all heat sinks.
- Altitude: Less than 3300 feet (1000 meters) above sea level.

⌘ **NOTE:** The starter rating must be derated 1% for every 330 feet (100 meters) above 3300 feet (1000 meters).

EMC Installation Guidelines

General

In order to help our customers comply with European electromagnetic compatibility standards, Benshaw Inc. has developed the following guidelines.

Attention: This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the installer may need to use additional mitigation methods.

Grounding

Connect a grounding conductor to the screw or terminal provided as standard on each controller. Refer to layout/power wiring schematic for grounding provision location.

Wiring

Wire in an industrial application can be divided into three groups: power control and signal. The following recommendations for physical separation between these groups are provided to reduce the coupling effect;

- Different wire groups should cross at 90 degrees inside an enclosure.
- Minimum spacing between different wiring groups in the same tray should be six inches.
- Wire that runs outside an enclosure should be run in conduit or have shielding/armor with equivalent attenuation.
- Different wire groups should be run in separate conduits.
- Minimum spacing between conduits containing different wire groups should be three inches (8cm).

Installation Procedures

General Information

Installation of some models may require halting production during installation. If applicable, ensure that the starter is installed when production can be halted long enough to accommodate the installation.

Before installing the starter, ensure:

- The wiring diagram (supplied separately with the starter) is correct for the required application.
- The starter is the correct current rating for the motor being started.
- All of the installation safety precautions are followed.
- The correct power source is available.
- The starter control method has been selected.
- The necessary installation tools and supplies are obtained.
- The installation site meets all environmental specifications for the starter NEMA/CEMA rating.
- The motor being started has been installed and is ready to be started.
- Any power factor correction capacitors (PFCC) are installed on the power source side of the starter and not on the motor side.

⌘ **NOTE:** Failure to remove power factor correction or surge capacitors from the load side of the starter will result in serious damage to the starter which will not be covered by the starter's warranty. The capacitors must be powered from the line side of the starter. The up-to-speed contact must be used to energize the capacitors after the motor has reached full speed.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel familiar with medium voltage equipment are to perform work described in this set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- Use a properly rated voltage sensing device to confirm that the power is off.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power. Assume that circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Safety Precautions

To ensure the safety of the individuals installing the starter, and the safe operation of the starter, observe the following guidelines:

- Ensure that the installation site meets all of the required environmental conditions (Refer to Site Preparation, page 16).
- LOCK OUT ALL SOURCES OF POWER.
- Install circuit disconnecting devices (i.e., circuit breaker, fused disconnect or non-fused disconnect) if they were not previously installed by the factory as part of the package.
- Install short circuit protection (i.e., circuit breaker or fuses) if not previously installed by the factory as part of the package.
- Follow all NEC (National Electrical Code) and/or C.S.A. (Canadian Standards Association) standards.
- Remove any foreign objects from the interior of the enclosure.
- Ensure that wiring is installed by an experienced electrician.
- Ensure that the individuals installing the starter have protective eye wear and clothing.

The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of electrical shock, current carrying parts and other components of the starter should be inspected and replaced if damaged.

3.1 INSTALLATION

Installation

To begin installation:

- Read and follow all of the installation safety precautions.
- Procure the necessary installation tools and any supplies.
- Ensure the site has sufficient lighting for safe installation.
- Move the starter to the installation site.
- Ensure that the starter is positioned so that the cabinet door has ample clearance, and all of the controls are accessible.

⌘ **NOTE:** Moving some models may require more than one individual or lifting equipment (e.g., forklift, crane).

Control Wiring

The control wiring should be connected to suit the customers needs. The control terminals on the control cards are as follows:

RediStart Micro II Power Card (refer to card layout on page 129):

- TBP1-1 24VDC common for relay and reversing card
- TBP1-2 24VDC power for relay and reversing card

- TBP2-1 Run relay neutral
- TBP2-2 Run relay live
- TBP2-5 Run relay holding contact

- TBP3-1 General fault contact N.C. (not faulted)
- TBP3-2 General fault contact common
- TBP3-3 General fault contact N.O. (not faulted)
- TBP3-4 Programmable relay #1 N.O.
- TBP3-5 Programmable relay #1 common
- TBP3-6 Programmable relay #1 N.C.
- TBP3-7 Programmable relay #2 N.O.
- TBP3-8 Programmable relay #2 common
- TBP3-9 Programmable relay #2 N.C.

RediStart Micro II computer card inputs (refer to card layout on page 128):

- JC13-1 Heat sink thermal switch or external starter trip input.
- JC13-2 AC neutral.
- JC13-3 Run confirm.
- JC13-4 In-line monitoring.
- JC13-5 Disconnect monitoring.
- JC13-6 BIST.
- JC13-7 Bypass monitoring.
- JC13-8 Zero speed.
- JC13-9 Profile #2 select.
- JC13-10 External motor thermal overload reset.
- JC13-11 External computer reset.
- JC13-12 AC neutral.

RediStart Micro II Four (4) Relay Card (refer to card layout on page 130):

- TB2-1 Optional programmable relay #1 N.O.
- TB2-2 Optional programmable relay #1 N.C.
- TB2-3 Optional programmable relay #1 common
- TB2-4 Optional programmable relay #1 N.O.
- TB2-5 Optional programmable relay #1 N.C.
- TB2-6 Optional programmable relay #1 common
- TB2-7 Optional programmable relay #2 N.O.
- TB2-8 Optional programmable relay #2 N.C.
- TB2-9 Optional programmable relay #2 common
- TB2-10 Optional programmable relay #2 N.O.
- TB2-11 Optional programmable relay #2 N.C.
- TB2-12 Optional programmable relay #2 common
- TB2-13 Optional programmable relay #3 N.O.
- TB2-14 Optional programmable relay #3 N.C.
- TB2-15 Optional programmable relay #3 common
- TB2-16 Optional programmable relay #3 N.O.
- TB2-17 Optional programmable relay #3 N.C.
- TB2-18 Optional programmable relay #3 common
- TB2-19 Optional programmable relay #4 N.O.
- TB2-20 Optional programmable relay #4 N.C.
- TB2-21 Optional programmable relay #4 common
- TB2-22 Optional programmable relay #4 N.O.
- TB2-23 Optional programmable relay #4 N.C.
- TB2-24 Optional programmable relay #4 common

RediStart Micro II seven (7) Relay Card (refer to card layout on page 130):

- TB2-1 Optional programmable relay #1 N.O.
- TB2-2 Optional programmable relay #1 common
- TB2-3 Optional programmable relay #1 N.C.
- TB2-4 Optional programmable relay #2 N.O.
- TB2-5 Optional programmable relay #2 common
- TB2-6 Optional programmable relay #2 N.C.
- TB2-7 Optional programmable relay #3 N.O.
- TB2-8 Optional programmable relay #3 common
- TB2-9 Optional programmable relay #3 N.C.
- TB2-10 Optional programmable relay #4 N.O.
- TB2-11 Optional programmable relay #4 common
- TB2-12 Optional programmable relay #4 N.C.
- TB2-13 Optional programmable relay #5 N.O.
- TB2-14 Optional programmable relay #5 common
- TB2-15 Optional programmable relay #5 N.C.
- TB2-16 Optional programmable relay #6 N.O.
- TB2-17 Optional programmable relay #6 common
- TB2-18 Optional programmable relay #6 N.C.
- TB2-19 Optional programmable relay #7 N.O.
- TB2-20 Optional programmable relay #7 common
- TB2-21 Optional programmable relay #7 N.C.

3.1 INSTALLATION

Power Wiring

Thread the power and motor cables through a connector into the enclosure. Strip away the motor cable insulation and apply anti-oxidation paste to the conductors.

Attach the motor cables:

- Use the T1, T2 and T3 lugs or terminals.

Attach the power source cables:

- Use the L1, L2 and L3 lugs or terminals.

The following is a list of the recommended crimp-on wire connectors manufactured by Penn-union Corp.

Wire Size	Part #		Wire Size	Part #
1/0	BLU-1/0S20		500 MCM	BLU-050S2
2/0	BLU-2/0S4		600 MCM	BLU-060S1
3/0	BLU-3/0S1		650 MCM	BLU-065S5
4/0	BLU-4/0S1		750 MCM	BLU-075S
250 MCM	BLU-025S		800 MCM	BLU-080S
300 MCM	BLU-030S		1000 MCM	BLU-100S
350 MCM	BLU-035S		1500 MCM	BLU-150S
400 MCM	BLU-040S4		2000 MCM	BLU-200s
450 MCM	BLU-045S1			

Power Factor Capacitors

Power factor correction capacitors and surge capacitors MUST NOT be connected between the RediStart Micro II and the motor. These devices can damage the SCR's in the package during ramping. These devices appear like a short circuit to the SCR when it turns on, which causes a di/dt level greater than the SCR can handle. If used, power factor correction capacitors or surge capacitors must be connected ahead of the RediStart Micro II. Programmable relay #2 (K2) must be set to an up-to-speed (UTS) contact (up-to-speed is the default setting) and then used to pull-in a contactor to connect the capacitors after the motor has reached full speed.

⌘ **NOTE:** The motor manufacturer should be contacted before surge capacitors are removed from the motor terminal box.

Finishing

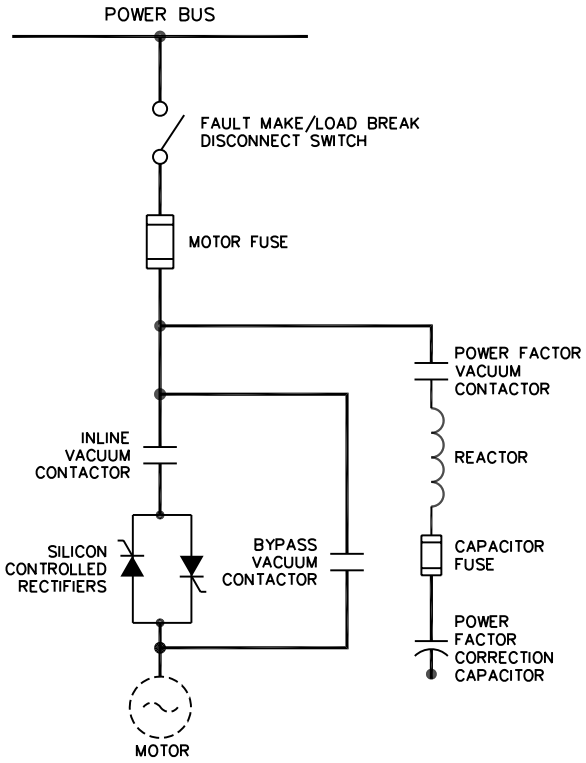
After all of the safety precautions and installation procedures have been completed, verify that the following settings are correct for the application:

- Current transformer scaling switches.
- RediStart Micro II computer card jumpers.

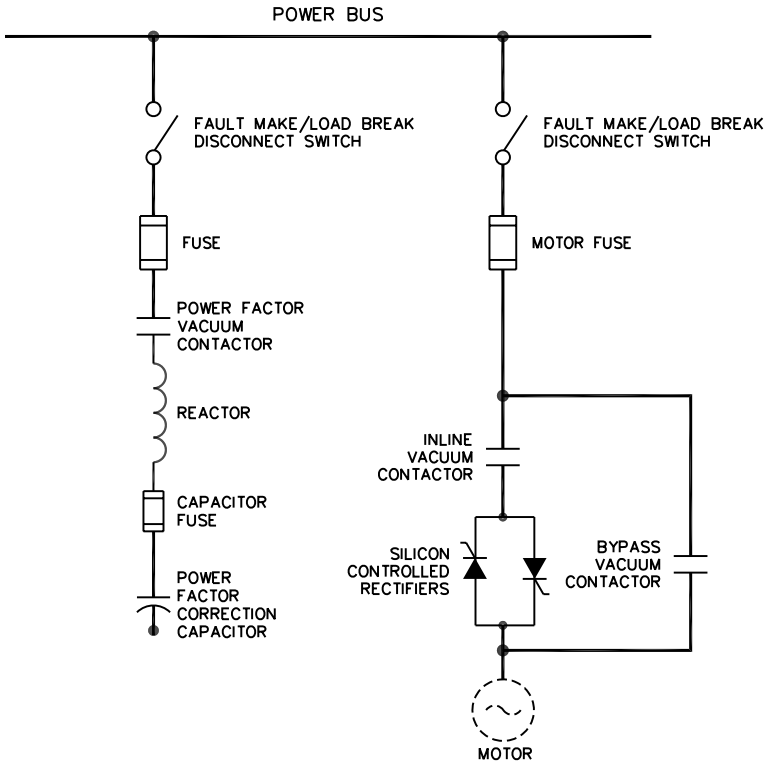
Power Factor Correction

The controller can be installed on a system with power factor correction capacitors. the capacitor must be located on the line side of the controller. This is required to prevent damage to the SCRs in the Micro II controller. A separate switching contactor is recommended to apply the capacitors only after the bypass contactor has closed, and to remove them when the bypass contactor opens.

Two Versions of a Typical One-Line Diagram



Above: PFCC using starter disconnect and fuses



Above: Stand Alone PFCC

⌘**NOTE:** Reactors are not required for all applications.

Preventative Maintenance

General Information

Preventative maintenance performed on a regular basis will help ensure that the starter continues to operate reliably and safely. The frequency of preventative maintenance depends upon the type of maintenance and the installation site's environment.

⌘ **NOTE:** Preventative maintenance should always be performed by a trained technician.

Preventative Maintenance

During Commissioning;

- Torque all power connections during commissioning. This includes pre-wired equipment.
- Check all of the control wiring in the package for loose connections.

For the first month after the starter has been put in operation;

- Re-torque all power connections every two weeks. This includes pre-wired equipment.
- Inspect any cooling fans after two weeks to ensure proper operation.

After the first month of operation;

- Re-torque all power connections every year.
- Clean any accumulated dust from the starter using a clean source of compressed air.
- Inspect the cooling fans every three months to ensure proper operation.
- Clean or replace any air vent filters on the starter every three months.

Inspections

- Set Annual schedules
- Periodic Inspection (visual)

Vacuum Contactors

Please refer to Chapter 7 for maintenance on vacuum contactors and disconnect switches.

⌘ **NOTE:** If mechanical vibrations are present at the installation site, inspect the connections more frequently.
⌘ **NOTE:** For more Maintenance information see Chapter 7: Maintenance.

Power Module

General Information

The controller is made up of three power modules, one for each phase. Each power module consisting of both incoming and outgoing terminals for cables, SCRs, heatsink and clamp assembly. The SCRs are connected to form a three phase AC line controller configuration by an inverse parallel series of 12- or 18- SCR assemblies.

The assembly also includes a gate driver circuit which obtains its power from a shared 28V, 300VA transformer.

CT Ratio Scaling

General Information

The motor current signal scaling is set according to the motor current specified when the starter is ordered. To ensure accurate operation, the motor current signal must be correctly scaled for the motor current being controlled by the starter. Motor current signal scaling may have to be changed if the motor size has been changed from the original specification. Motor current signal scaling is accomplished by verifying the current transformer ratio as supplied with the starter and then selecting the correct DIP switch setting from the chart on the following page for the current transformer ratio.

The DIP switches are:

- ON in the right position
- OFF in the left position

⌘ **NOTE:** Adjust the DIP switches only when the motor is stopped, or the switches could be damaged.

Confirm Switch Settings

To verify or change the motor current signal scaling:

- Compare the CT ratio stamped on each CT to the CT ratio listed on the wiring diagram supplied with the starter to ensure the correct CTS are installed.
- Inspect the RediStart Micro II power card to ensure that the DIP switches are in the correct positions for the applicable CT ratio and the motor full-load current (FLA) rating.

Switch Settings

CT Ratio	Motor FLA	Switch 1	Switch 2
288:1	3A to 9A	Off	Off
288:1	9A to 24A	On	Off
288:1	25A to 60A	On	On
864:1	20A to 24A	Off	Off
864:1	25A to 70A	On	Off
864:1	71A to 180A	On	On
2640:1	40A to 80A	Off	Off
2640:1	81A to 200A	On	Off
2640:1	201A to 500A	On	On
5760:1	70A to 160A	Off	Off
5760:1	161A to 400A	On	Off
5760:1	401A to 1200A	On	On

Changing FLA

If the actual motor FLA has been changed from the motor FLA documented on the purchase order:

- The DIP switch positions may need to be changed.
- Different CTS may have to be installed in the starter and the current transformer ratio parameter may need to be changed (Refer to current transformer ratio parameter, page 90).

(Optional) Remote RTD Module

General

The RediStart Micro II can have up to 2 RTD modules installed. The RTD modules can be installed in the cabinet with the RediStart Micro II or they can be installed remotely at the motor. Refer to the Remote RTD Module manual for details on this module.

MODBUS Master Card

The local I/O Bus controller card (BIPC-300017-X-X) is installed on the RediStart Micro II CPU card to allow the starter to communicate with the RTD Module.

RediStart Micro II Computer Card Jumpers

General Information

The RediStart Micro II computer card has a number of jumpers that affect the operation of the starter. In some cases, these jumpers will over-ride the programmed values.

JPC5 - LCD Start button

The LCD Start button can be enabled or disabled by this jumper. The LCD Start button is factory enabled unless the purchase order requests that the LCD Start button is disabled. The LCD Start button is controlled by jumper JPC5 on the RediStart Micro II computer card (Refer to RediStart Micro II computer card layout on page 128).

Mode	Position
Enable	1-2
Disable	2-3

JPC7 - Overload Auto/Man.

The motor thermal overload can be set to require a manual reset or to automatically reset after a thermal trip. The motor thermal overload is set to the manual reset position unless the purchase order requests that the motor thermal overload is set to the automatic reset position. The motor thermal overload reset is controlled by jumper JPC7 on the RediStart Micro II computer card (Refer to RediStart Micro II computer card layout on page 128).

Mode	Position
Automatic Reset	1-2
Manual Reset	2-3

JPC13 - LCD Stop Button

The LCD Stop button can be enabled or disabled by this jumper. The LCD Stop button is factory enabled unless the purchase order requests that the LCD Stop button is disabled. The LCD Stop button is controlled by jumper JPC13 on the RediStart Micro II computer card (Refer to RediStart Micro II computer card layout on page 128).

Mode	Position
Enable	1-2
Disable	2-3

JPC17 & JPC18 - Voltage Select

The RediStart Micro must be set for the line voltage that it is operating on. This is so that it will know the voltage to be able to implement the high/low voltage protection feature. The line voltage should be set to the voltage requested when the starter was ordered since the power poles and control power transformer must change for different line voltages. The line voltage is set by JPC17 on the RediStart Micro computer card, which works in conjunction with JPC18. (Refer to RediStart Micro computer card layout on page 128).

Voltage	JPC17	JPC18
2400	2-3	2-3
3300	1-2	1-2
4160	1-2	2-3
4800	2-3	1-2
6600	2-3	2-3

JPC19 - Fault Reset

The RediStart Micro II can be set to either require a manual reset or automatically reset after a fault occurs. The RediStart Micro II is set for manual fault reset unless the purchase order requests that the fault reset jumper is set to automatic. The fault reset is controlled by jumper JPC19 on the RediStart Micro II computer card (Refer to RediStart Micro II computer card layout on page 128).

Mode	Position
Automatic Fault Reset	1-2
Manual Fault Reset	2-3

The automatic fault reset works in conjunction with the # auto resets parameter (see page 75) and the Fault Classes sub-menu (see page 76).

The # auto resets parameter sets how many non-critical faults will be reset in one hour. Once this number has been reached, the starter will not automatically reset the next fault. When this occurs, the user should check the event recorder for the cause of the faults and correct the problem.

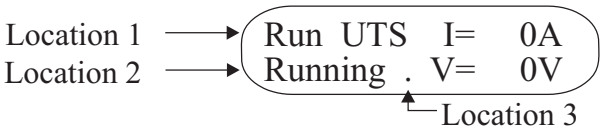
The fault classes sub-menu allows the user to set faults as critical, non-critical, disabled, warning relay A, warning relay B or warning relay C. When JPC19 is set to automatic fault reset and a fault is set to non-critical, the RediStart Micro II will automatically reset the fault.

4. OPERATION

Main Display Messages

General

During normal operation, the RediStart Micro II can show a number of different operating messages on the display. These messages give information on the present operating state of the starter and motor. There are three locations where messages are displayed as shown in the following diagram.



Messages

The messages, display locations and descriptions are as follows:

Message	Location	Description
Stop	1	Starter is in a stopped state.
BKS hld	1	Backspin timer is active.
TBS hld	1	Time between starts is active.
SPH hld	1	Starts per hour is active.
BKS LOC	1	Backspin timer is locked.
TBS LOC	1	Time between starts counter has locked.
SPH LOC	1	Starts per hour counter has locked.
RUN	1	Starter is applying power to motor.
Stopping	1	Stop command was applied, motor is being stopped.
RUN UTS	1	Starter is running and motor is at full speed.
XXX.Xmin	2	Next start cannot be performed for xxx.x min.
PH Err	2	The phase order is incorrect.
Freq Err	2	The line frequency is outside of the trip settings.
Volt Err	2	The line voltage is outside of the trip settings.
OCT Trip	2	Motor current went above the over current trip setting.
UCT Trip	2	Motor current went below the under current trip setting.
GDF Trip	2	A ground fault was detected.
Door In	2	The Disconnect switch is open.
No Line	2	Line voltage is not present.
OL Warn	2	Motor thermal overload is over 90% content.
OL Trip	2	Motor thermal overload is tripped and reset is allowed.
OL Lock	2	Motor thermal overload tripped and reset is not allowed.
Ready	2	All conditions OK to run.
Accel	2	Starter is ramping.
Accel 2	2	Starter is ramping using 2nd ramp profile.
Running	2	Starter ramp profile is complete.
Kicking	2	Starter is applying kick start current.
Kicking 2	2	Starter is kicking using 2nd ramp profile.
Decel	2	Motor is decelerating.
ComLoss	2	Modbus communications lockout.
RTD Alar	2	A RTD went over its alarm setting.
RTD ComF	2	Communications with an RTD module was lost.
RTD Open	2	A RTD is detected as being open.
RTD Shor	2	A RTD is detected as being shorted.
RTD Warn	2	A RTD went over its warning setting.
Open In	2	External input is open.
PORT	2	The starter is in Power Outage Ride-Through mode.
. (dot)	3	Password protection is enabled.

Meter Display Pages

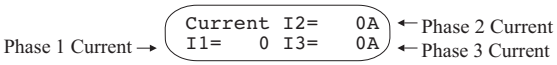
General

Besides the main display, the RediStart Micro II has a number of other display pages that show various operational values. By pressing the Up or Down arrow buttons, it is possible for the user to view all operational information without having to enter the menu system. The display pages are described below in the order they appear when pressing the Up button.

⌘ **NOTE:** Not every display page shown here may be present depending on the options provided with the starter.

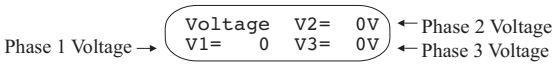
Current Page

The current meter page displays the currents for all three phases.



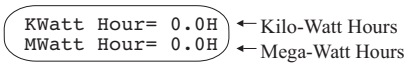
Voltage Page

The voltage page displays the voltages for all three phases.



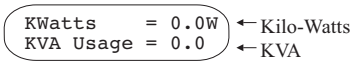
Kilo-Watt Hour Page

The Kilo-Watt Hour power page displays the true power measurements for the motor.



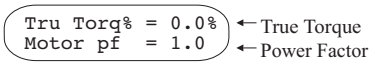
Power Page

The power page displays the KW and kVA power measurements for the motor.



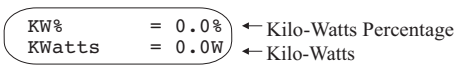
TruTorque Page

The TruTorque page displays the Tru Torque % and Power Factor measurements for the motor.



KW Control Page

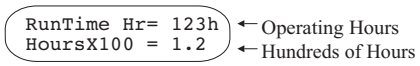
The KW control page displays the KW% and kilo-watt measurements for the motor.



4.1 OPERATION

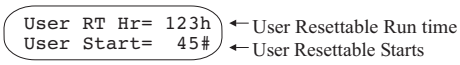
Runtime Page

The runtime page displays the runtime on the motor.



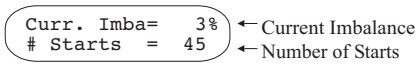
User Counts Page

The user counts page displays the user resettable runtime and number of starts.



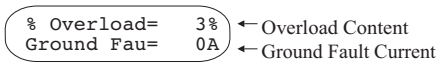
Motor #1 Page

The motor #1 page displays the motor current imbalance as a percentage and the number of motor starts.



Motor #2 Page

The motor #2 page displays overload content and ground fault current information.

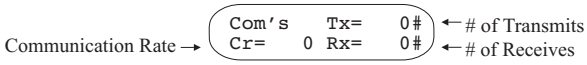


Motor #3 Page

The motor #3 page displays operating frequency and motor power factor information.

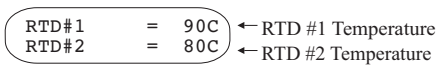
Communications Page

The communications page displays the communications statistics.

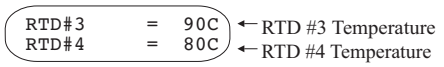


RTD #1 & #2 Temp.

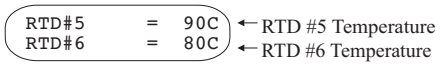
The RTD #1 & #2 temperature page displays the temperatures those RTDs are measuring.



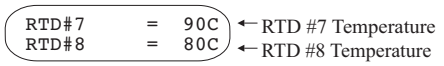
RTD #3 & #4 Temp. The RTD #3 & #4 temperature page displays the temperatures those RTDs are measuring.



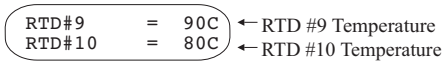
RTD #5 & #6 Temp. The RTD #5 & #6 temperature page displays the temperatures those RTDs are measuring.



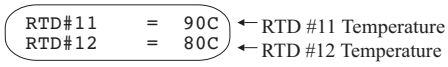
RTD #7 & #8 Temp. The RTD #7 & #8 temperature page displays the temperatures those RTDs are measuring.



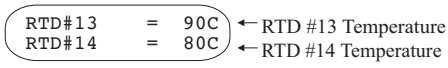
RTD #9 & #10 Temp. The RTD #9 & #10 temperature page displays the temperatures those RTDs are measuring.



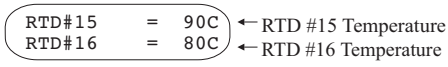
RTD #11 & #12 Temp. The RTD #11 & #12 temperature page displays the temperatures those RTDs are measuring.



RTD #13 & #14 Temp. The RTD #13 & #14 temperature page displays the temperatures those RTDs are measuring.

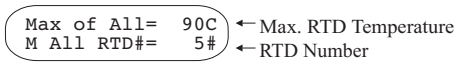


RTD #15 & #16 Temp. The RTD #15 & #16 temperature page displays the temperatures those RTDs are measuring.



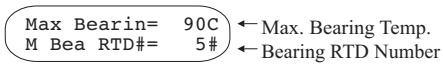
Max. RTD Temp.

The maximum RTD temperature page displays the temperature and RTD number from the highest measuring RTD.



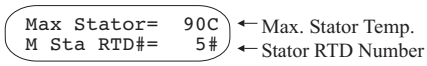
Max. Bearing RTD Temp.

The maximum bearing RTD temperature page displays the temperature and RTD number from the highest measuring RTD in the bearing group.



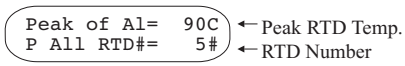
Max. Stator RTD Temp.

The maximum stator RTD temperature page displays the temperature and RTD number from the highest measuring RTD in the stator group.



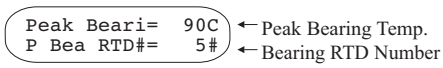
Peak RTD Temp.

The peak RTD temperature page displays the highest peak temperature reached and the number of the RTD that read the temperature.



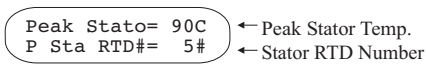
Peak Bearing RTD Temp.

The peak bearing RTD temperature page displays the highest bearing temperature reached and the number of the RTD that read the temperature.



Peak Stator RTD Temp.

The peak stator RTD temperature page displays the highest stator temperature reached and the number of the RTD that read the temperature.



Parameters

Parameter Usage

The description and use of each parameter is described in the programming section of the manual. Most parameters are fairly straight forward and don't require any further explanation. The rest of this chapter gives a more detailed description of the use of the parameters that are more complicated to use.

Starter Modes

Description

The Starter Mode sub menu (see page 51) contains parameters for selecting the type of start and stop to perform. By allowing the user to select the start and stop mode the system can be operated in the optimal start and stop fashion for the load. Below are the available modes along with some examples for typical applications.

Start Modes

Curr (Current Ramp): The current ramp is ideal for most general-purpose motor control applications; Examples: crushers, ball mills, compressors, saws, and centrifuges).

The Current Ramp applies to the following in the Starter Setup Main Menu: Forward1 Profile, Forward2 Profile.

TT (TruTorque): The TruTorque ramp is suitable for applications that require a minimum of torque transients during starting or for consistently loaded applications that require a reduction of torque surges during starting; Examples: pumps, fans, and belt driven equipment).

The TruTorque ramp applies to the following in the Starter Setup Main Menu: TruTorque Ramp

Tach (Tachometer Feedback): The tachometer feedback ramp is for applications where torque transients must be held to a minimum, and the starting load is unknown, varies, or changes during the start cycle; Examples: Belts, and conveyors.

The Tachometer ramp applies to the following in the Starter Setup Main Menu: Tachometer Setup

KW (Power Control): The power control ramp is suitable for applications that require a controlled input power profile during acceleration. Applications include starter operation on generators and other limited power source situations.

Stop Modes

Coas (Coast): A coast stop should be used when no special stopping requirements are necessary; Example: crushers, balls mills, centrifuges, belts, conveyor.

There is no menu that applies in the Starter Setup Main Menu.

VDCL (S Curve Voltage Deceleration): A standard open loop S-Curve voltage deceleration is best suited for applications such as pumps and compressors.

The S Curve Voltage Deceleration applies to the following in the Starter Setup Main Menu: Decel Setup

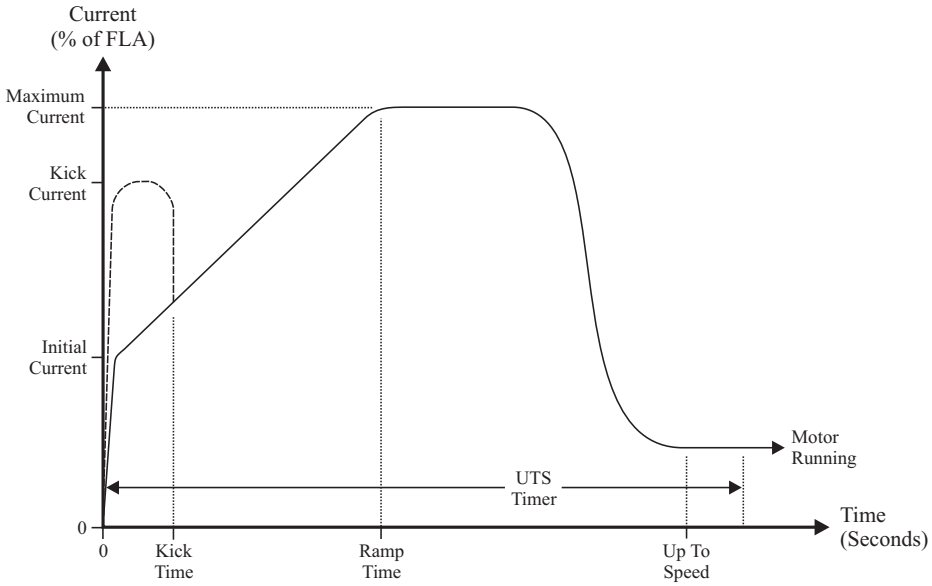
TT (TruTorque): The TruTorque deceleration is best suited to pumping and compressor applications where pressure surges during a stop must be eliminated. This setup is easier than the S-Curve Voltage Deceleration and is less source voltage dependent.

The TruTorque deceleration applies to the following in the Starter Setup Main Menu: TruTorque Ramp

Current Ramp Adjustment

Current Ramp

The current ramp sets how the motor accelerates. The current ramp is a linear increase in current from the initial setting to the maximum setting. The ramp time sets the speed of this linear current increase. The following figure shows the relationships of these different ramp settings.



Initial Current Setting

The initial current should be set to the level that allows the motor to begin rotating within a couple of seconds of receiving a start command.

To adjust the initial current setting give the starter a run command. Observe the motor to see how long it takes before it begins rotating and then stop the unit. For every second that the motor doesn't rotate, increase the initial current by 20%. Typical loads will require an initial current in the 50% to 175% range.

Maximum Current Setting

For most applications, the maximum current can be left at 600%. This will ensure that enough current is applied to the motor to accelerate it to full speed.

The maximum current can also be set to a lower current limit. This is usually done to limit the voltage drop on the power system or to limit the torque the motor produces to help prevent damage to the driven load.

⌘ **NOTE:** The motor may achieve full speed at any time during the current ramp. This means that the maximum current setting may not be reached. Therefore, the maximum current setting is the most current that could ever reach the motor, and not necessarily the maximum current that will reach the motor.

⌘ **NOTE:** When setting a current limit, the motor must be monitored to ensure that the current is high enough to allow the motor to reach full speed under worst case load conditions.

Ramp Time Setting

The ramp time is the time it takes for the current to go from the initial current to the maximum current. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

If the ramp time expires before the motor reaches full speed, the starter will maintain the set maximum current level until either the motor reaches full speed, the UTS timer expires, or the motor thermal overload trips.

⌘ **NOTE:** Setting the ramp time to a specific value does not necessarily mean that the motor will take this time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum current to reach full speed. Alternatively, the motor and load may take longer than the set ramp time to achieve full speed.

Programming A Kick Current

General

The kick current sets a current level that overrides the current ramp when a start is first commanded. The kick current is only useful on motor loads that are hard to get rotating but then are much easier to move once they are rotating. An example of a load which is hard to get rotating is a ball mill. The ball mill requires a high torque to get it to rotate the first quarter turn (90°). Once the ball mill is past 90° of rotation, the material inside will begin tumbling and it is easier to turn.

Kick Current

The kick current parameter is usually set to a low value and then the kick time is adjusted to get the motor rotating. If the kick time is set to more than 2.0 seconds without the motor rotating, increase the kick current by 100% and re-adjust the kick time.

Kick Time

The kick time adjustment should begin at 0.5 seconds and be adjusted by 0.1 or 0.2 second intervals until the motor begins rotating. If the kick time is adjusted above 2.0 seconds without the motor rotating, start over with a higher kick current setting.

Tachometer Feedback

Description

The Tachometer control ramp profile (see page 56)provides a method to linearly ramp the speed of the system. When this control mode is selected, the starter uses a tachometer to provide speed feedback to the starter. This mode is commonly used on conveyor belt applications where a smooth controlled start is necessary under various load conditions to prevent belt breakage, lifting, or excessive stretching. The Tachometer controller consists of an inner PID current loop and an outer PI speed control loop.

⌘ **NOTE:** The maximum current limit will override the speed control loop if necessary. If the Maximum Current level is not set high enough or the load is too great, the RediStart Micro II starter will limit the motor current to this maximum level. When current limiting occurs, the speed profile will no longer be linear and the motor(s) will take longer to accelerate to full speed. Therefore, if current limiting is undesirable, this parameter must be set higher than the peak starting current during a linear speed ramp start.

Tachometer Requirements

In addition to the basic motor and starter setup variables, the following needs to done to use the tachometer feedback control ramp:

1. Connect a tachometer with appropriate DC output voltage and correct polarity to the Redistart Micro II power card input (terminal TBP13).
2. The tachometer feedback Start Mode is selectable as “Tach” from the Starter Modes menu.
3. Program the appropriate variables in the Tachometer Setup menu.
4. Set the Initial Current level in either the Quick Start menu or the Forward1 Profile menu to the desired starting current.
5. Set the Maximum Current level in either the Quick Start menu or the Forward1 Profile menu to the desired maximum current limit.

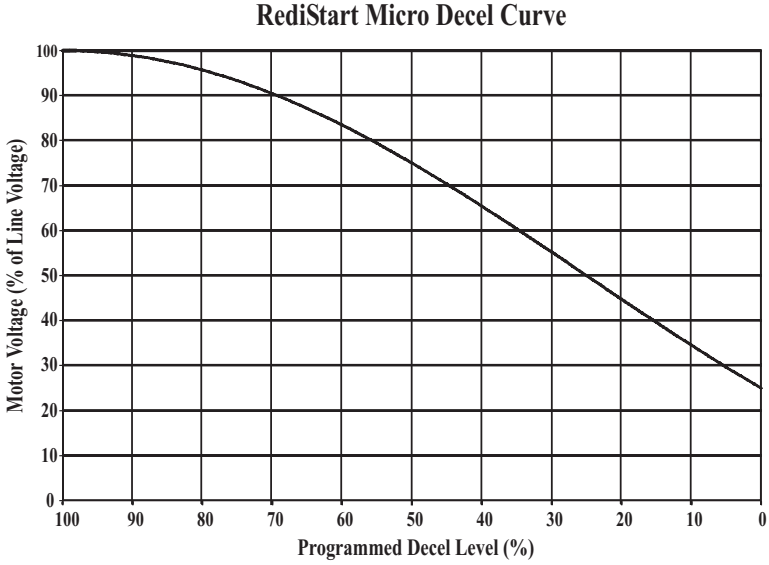
Programming The Motor Deceleration

Deceleration Control

The standard deceleration control on the RediStart Micro II uses an open loop voltage ramp. The RediStart Micro II will ramp the voltage down to decelerate the motor. The curve shows the motor voltage vs the decel setting.

As a default, Stop mode is set to coast-to-stop. V-DCL needs to be turned on to utilize voltage deceleration control.

Set Stop Mode in QuickStart to V-DCL.



Decel Level 1

This sets the starting voltage of the deceleration ramp. Most motors require the voltage to drop to around 60% or lower before any significant deceleration is observed. Therefore, a good first setting for this parameter is 35%.

To adjust this parameter, it is necessary to observe the motor operation as soon as a stop is commanded. If the motor hunts (speed oscillations) at the beginning of the deceleration, then lower the parameter by 5%. If the motor has a big drop in speed as soon as a stop is commanded, then raise the parameter by 5%.

Some motors are very sensitive to the adjustment of this parameter. If a 5% adjustment changes the motor from hunting to dropping in speed, then a smaller change of 1% or 2% may be necessary.

Decel Level 2

This sets the final voltage for the deceleration ramp. In most cases, this parameter can be set to 10% and the decel time can be used to adjust the deceleration rate. If the motor is coming to a stop too quickly or if the starter continues to apply current to the motor after the motor has stopped, this parameter can be increased in 5% increments to fix this.

Decel Time

The decel time sets how quicky the motor decelerates. Usually a time of 30 seconds is a good starting point. To make the motor take longer to decelerate, increase this parameter or to make the motor decelerate quicker, decrease this parameter.

PORT (Power Outage Ride Through)

Description

The Power Outage Ride Through capability (see page 60) allows the starter to ride through short duration brown outs, single phase, and power loss conditions. The control power must be provided by UPS.

When the system senses a voltage disturbance in a time frame greater than the Sense Time parameter, the power will be removed from the motor for a coast to stop, and the Fault Dly timer will begin to time; if it is not set to OFF.

If the power disturbance ends before the programmed Fault Dly time, the motor will restart -- if a start command is still present -- from initial to maximum current in the specified ramp time.

If the outage lasts longer than the programmed Fault Dly time, the starter will issue a Fault 98; “No Mains PWR.”

If Fault Dly is set to OFF, the starter will use the standard motor protection fault delay timers to sense power disturbances.

⌘ **NOTE:** Starts/Hou (starts per hour), Time Start (time between starts), and BKS Timer (backspin timer) are not incremented for PORT.

⌘ **NOTE:** If the system Start Mode parameter is programmed with a tachometer ramp, the system will restart using a tachometer ramp.

Bypass Delay

PORT can also hold a bypass contactor in for a programmed BYP Dly when the power disturbance is Sensed.

⌘ **NOTE:** The BYP Dly is fixed at 0.0 seconds to protect systems that contain an integral bypass card.

⌘ **NOTE:** Caution must be taken when the BYP Dly is set above 0.0 seconds. If the bypass contactor is energized when the power disturbance ends, the motor will start across the line. The resulting torque may damage the system (consult factory for application assistance).

⌘ **NOTE:** To activate this feature, the control voltage must be supplied by a UPS control.

PORT Detection

The starter can be detected in PORT operation by monitor of the PORT relay output; selectable on any of the programmable relays. Once programmed, this relay can be used to feed 120VAC to input 9 of the JC13 terminal block on the computer card. This causes the system to use the Forward2 Profile for starting the motor.

TruTorque Acceleration Ramp

TruTorque Ramp

The TruTorque ramp sub-menu (see page 61) contains the parameters that are used to tune TruTorque Acceleration and Deceleration Control.

The primary purpose of TruTorque Control is to reduce the torque surge that occurs as an AC induction motor comes up to full speed. This torque surge can be a problem in pumps and belt driven applications. In pumping applications this torque surge results in a pressure peak as the motor comes up to speed. In most situations this small pressure peak is not a problem. However in selected cases, even a small pressure peak can be highly undesirable. In belt drive applications, TruTorque prevents the slipping of belts as the motor reaches full speed.

⌘ **NOTE:** When TruTorque acceleration control is enabled the second ramp (Ramp #2) and Kick Current functions are disabled.

TruTorque control can be very useful for a variety of applications. However it is best used for pump and other variable torque applications. TruTorque generally should not be used in applications where the starting load varies greatly from one start to another.

Initial Torque

This value sets the initial torque value for the motor. The initial torque level should be set to a level that allows the motor to begin rotating within a couple of seconds of receiving a start command. Typical loads will require values between 10% to 30%

If the value is set too high a current surge may result. If the value is set too low a "No current at Run" fault may occur.

Maximum Torque

This value sets the final torque reference value at the end of the ramp time. Typical loads require a value around 100-110%. If the load is less than motor rating then the maximum torque value can be decreased. If the load is hard to start or the motor is a NEMA C or D type motor then this value may need to be increased.

If the motor reaches full speed too quickly then decrease the Maximum Torque value by 5% and retest. If the motor does not achieve full speed, increase the Maximum Torque value by 10% and retest.

If the motor can be started either by using default TruTorque values or current ramp control, the Maximum Torque value can be more precisely determined so that the motor comes up to speed in approximately the preset Ramp Time. In this case, while the motor is running at full load, display the TT% meter on the display (see Meter Setup for information on how to display the TT% meter). Record the value displayed when the motor is running with full load. The Maximum Torque value should then be set to the recorded running value of TT% plus an additional 10%. Retest with this value to verify correct operation.

⌘ **NOTE:** When setting the Maximum Torque value the motor must be monitored to ensure that the torque is high enough to allow the motor to reach full speed under worst case load conditions.

Ramp Time

The Ramp Time setting is the time it takes for the torque to go from the Initial Torque Setting to the Maximum Torque Setting. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

If the ramp time expires before the motor reaches full speed the starter will maintain the set Maximum Torque level until either the motor reaches full speed, the UTS timer expires, or the motor thermal overload trips.

⌘ **NOTE:** Setting the ramp time to a specific value does not necessarily mean that the motor will take this time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum torque to reach full speed. Conversely, the motor and load may take longer than the set ramp time to achieve full speed.

TruTorque Deceleration Ramp

General

The TruTorque ramp sub-menu (see page 61) contains the parameters that tune TruTorque Acceleration and Deceleration Control.

TruTorque deceleration is a closed-loop deceleration control. The RediStart Micro II will ramp down the torque to smoothly decelerate the motor. TruTorque deceleration is very simple to setup. Set Stop Mode in Quickstart to TT.

TruTorque Decel Mode

TruTorque Decel Mode needs to be turned on to utilize TruTorque deceleration control. When TruTorque deceleration is enabled the TruTorque deceleration settings listed below will be used for deceleration control.

TT End Decel Torque

The value sets the final torque level for the TruTorque deceleration ramp. In most cases, this parameter can be set to 10%.

To adjust this parameter, it is necessary to observe the motor. If the motor is coming to a stop too quickly or if the starter continues to apply current to the motor after the motor has stopped this parameter can be increased in 5% increments.

If the motor is still rotating when the desired deceleration time has expired, decrease this parameter by 5% and retest.

TT Decel Ramp Time

The TruTorque deceleration time sets how quickly the motor decelerates. Usually a time of 30 seconds is a good starting point. To make the motor decelerate at a slower rate increase this time or to make the motor stop quicker decrease this time.

Rated Motor PF

This parameter is used during TruTorque control to adjust the control algorithm scaling based on the actual motor rated power factor. It is also used to properly scale the %TT output meter. If using TruTorque control for either acceleration or deceleration control, it is very important to set this parameter to meet the correct rated motor power factor (usually available on the motor nameplate). For most motors this value is between 0.80 and 0.95.

KW (Power Control) Acceleration Ramp

Power Control Ramp

The KW power control acceleration ramp is used to control the input power to the motor during acceleration. This ramp can be especially useful in applications that are supplied by "soft" or smaller power sources such as generators.

Initial Power

When using KW (power) control, this parameter sets the initial motor power that will be allowed when the motor starts. Typical loads will require values between 10%-30%. This parameter should be set to a level that allows the motor to begin to accelerate within a few seconds of a start command being received. If the value is set too high then a current surge may result. If the value is set too low a "No Current at Run" fault may occur.

Final Power

When using KW (power) control this parameter sets the final or maximum power that will be achieved at the end of the ramp time. If the maximum power value is set too low the motor may not produce enough torque to reach full speed (UTS). If the value is set higher than needed the motor will reach full speed faster (earlier) than expected.

Ramp Time

The ramp time setting is the time that it takes for the power level to go from the Initial Power Setting to the Maximum Power Setting. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

If the ramp time expires before the motor reaches full speed, the starter will maintain the Maximum power level until either the motor reaches full speed, the UTS timer expires, or the motor thermal overload trips.

⌘ **NOTE:** Setting the ramp time to a specific value does NOT necessarily mean that the motor will take this amount of time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum power to reach full speed. Conversely, the motor and load may take longer than the set ramp time to achieve full speed.

Rated Motor PF

This parameter is used during KW (power) control to adjust the control algorithm scaling based on the actual motor rated power factor. It is also used to properly scale the %KW output meter. If using KW ramp control for acceleration control, it is very important to set this parameter to the correct rated motor power factor (usually available on the motor nameplate). For most motors this value is between 0.80 and 0.95.

How Fault Classes Work

General

The Fault classes sub-menu (see page 76) allows starter behavior for different faults to be altered. There are six different options that a fault can be set to. These options are described in the following paragraphs. See page 100 for a complete fault code and description listing.

NonC

Non-critical fault. If this fault occurs, the starter will shut down and display the fault number and description on the display. A non-critical fault can be set to either require a manual reset or to automatically reset.

The automatic resetting of a non-critical fault is dependent on the automatic computer reset jumper JPC19 (see page 24). When JPC19 is set to auto reset (position 1-2), the starter will automatically reset the fault. The number of automatic resets parameter (# Auto RST) on page 75 sets how many times the starter will perform this automatic reset sequence in one hour. It must then be reset manually.

Crit

Critical fault. If this fault occurs, the starter will shut down and display the fault number and description on the display. To manually clear the fault, the computer reset button must be pressed or the control power to the starter cycled.

Dis

Fault is Disabled. If this condition occurs, the starter will ignore the condition and continue to operate.

WrnA

Fault warning relay A. If this condition occurs, the starter will continue to operate. If a programmable relay is programmed to WrnA, that relay will be energized when the condition occurs. The WrnA relay can be assigned to as many different conditions as the user requires.

WrnB

Fault warning relay B. If this condition occurs, the starter will continue to operate. If a programmable relay is programmed to WrnB, that relay will be energized when the condition occurs. The WrnB relay can be assigned to as many different conditions as the user requires.

WrnC

Fault warning relay C. If this condition occurs, the starter will continue to operate. If a programmable relay is programmed to WrnC, that relay will be energized when the condition occurs. The WrnC relay can be assigned to as many different conditions as the user requires.

Use of Overcurrent and Undercurrent

General

For the overcurrent and undercurrent trips, there are settings for the current level and the detect time. The motor current must go above or below the current level settings for the detect time before the overcurrent or undercurrent condition is declared. The overcurrent and undercurrent trips do not become active until the starter is up-to-speed (UTS is shown in top line of display).

Overcurrent

The overcurrent parameters are for the user to set a high current trip. The overcurrent parameters are not used for the thermal overload. If the driven load can be damaged by full motor torque being applied during a stall or , than the overcurrent should be used to protect it.

Undercurrent

The undercurrent parameters are for the user to set a low current trip. The undercurrent parameters are used to protect a driven load from running empty. A good example of the undercurrent trip usage is a water pump. If the pump can be damaged by running dry, the undercurrent parameters can be set to detect the low current and shut the pump down. To use this, the current could be set to 50% and the detect delay to 5 seconds to shut the pump down 5 seconds after the current falls below 50% of the motor FLA parameter.

Activating a Relay

To make the starter activate a relay when an overcurrent or undercurrent is detected, a programmable relay must be programmed to OCT or UCT respectively.

Tripping vs Running

As the default, the starter will trip when an overcurrent or undercurrent is detected. To keep the starter operating, the overcurrent fault (fault #78) or undercurrent fault (fault #79) must be set to dis (disabled) in the fault classes sub-menu (see page 76) to turn off the fault trip.

Once the overcurrent or undercurrent fault is disabled, the starter will not trip when the overcurrent or undercurrent condition is detected. The relay programmed to OCT or UCT will still operate when the condition is detected. Once the condition clears, the relay will remain active for the programmed release delay time. The user must monitor the relay output and take appropriate action when the relay is energized.

Overload

General

The RediStart Micro II comes with a programmable overload that allows classes 1-40 to be programmed. The thermal overload is displayed as a percentage of overload used, with 0% representing a “cold” overload and 100% representing a “tripped” overload. The overload is always calculated using the highest phase current.

Overload Classes

The overload class sets the time it takes for the overload to trip when the motor current is six (6) times the motor FLA. One of the forty standard overload curves may be programmed based on the manufacturer's locked rotor time capability. The overload follows an exponential curve that gives a long trip time for slight overloads and a short trip time for large overloads. This models the heating of a typical squirrel cage induction motor. See page 11 for the motor thermal overload curves.

Overload Operation

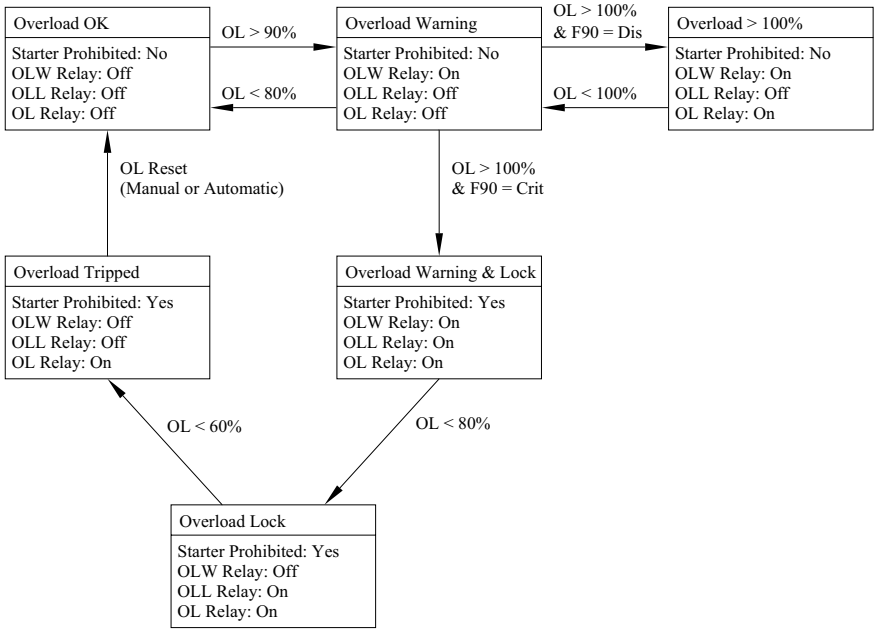
There are two ways that the overload can operate. The operation is changed in the fault classes sub-menu by changing the overload lock fault (fault #90) from Crit to Dis.

When fault #90 is set to Crit;

- The overload warning relay will energize when the O/L content goes above 90% and de-energize when the O/L content goes back below 80%.
- The starter will shut down if the overload content reaches 100%.
- The overload lock relay will energize when the O/L content reaches 100% and de-energize when the O/L content goes back below 60%.
- The starter will not allow an overload reset once the overload trips until the overload content goes back below 60%.
- The overload relay will energize when the overload trips and will de-energize when the overload condition is cleared by an automatic or manual reset.

When fault #90 is set to Dis;

- The overload warning relay will energize if the overload content goes above 90% and will de-energize when the overload content goes back below 80%.
- The starter will not shut down if the overload content reaches 100%.
- The overload lock relay will never energize.
- The overload relay will energize when the overload content goes above 100% and will de-energize when the overload content goes back below 100%.



Running Overload

When the RediStart Micro II is running the overload content will never discharge below 30%. The overload content will always hold at any value below 30% during the running period. As soon as the unit is stopped the overload will begin to discharge back to 0%.

Resolving Overload Trips

The National Electrical Code, article 430 Part C, allows for different overload multiplier factors depending on the motor and operating conditions.

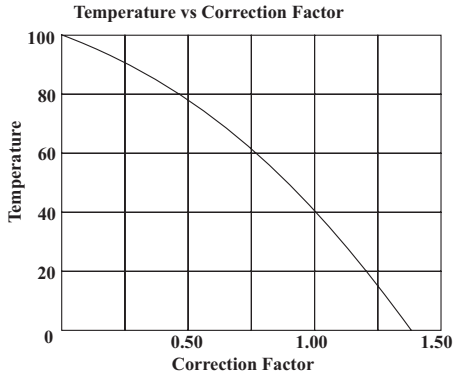
NEC section 430-32 outlines the allowable service factor (Serv. Fact) for different motors as follows:

Motor	Overload Multiplier
Service factor 1.15 or more	1.25
Motor temp. rise 40°C or less	1.25
All others	1.15

NEC section 430-34 permits further modifications if the service factor (Serv. Fact) is not sufficient to start the motor:

Motor	Overload Multiplier
Service factor 1.15 or more	1.40
Motor temp. rise 40°C or less	1.40
All others	1.30

Although the NEC doesn't address the effect of the ambient temperature of the motor location, guidance can be derived by examining NEC limits. If the motor is operating in an ambient temperature that is less than 40°C, then the overload multiplier can be increased while still protecting the motor from exceeding it maximum designed temperature. The following curve gives the ambient temperature vs the correction factor.



Example: If a motor operates at 0°C then a 1.36 correction factor could be applied to the overload multiplier. This could give a theoretical overload multiplier of 1.36 x 1.25 or 1.70. The highest legal value of overload multiplier is 1.40 so this could be used.

Performing an Emergency Restart

General

The RediStart Micro II has an emergency restart feature which allows the user to override any lock-outs that are present. This feature should only be used in an emergency. Before an emergency reset is performed, the reason for the lock-out and the condition of the motor should be examined to ensure that the motor is capable of being re-started without causing any damage.

Performing a Reset

Place a jumper between pins 6 and 11 of JC11 on the computer card. Hold the Enter button on the display and press the thermal overload reset pushbutton until a microprocessor reset occurs.

Notes:

5. PROGRAMMING

5.1 HOW TO PROGRAM

Menu Buttons

General

The RediStart Micro II has a display/keypad that allows the user to set the starter parameters using a plain English interface. The functions of the display buttons are as follows.

- Press to enter the menu system.
- Press to abandon changes made to a parameter (before pressing the Enter key).
- Press to exit a sub-menu.
- Press to exit the menu system.

- Press to enter a menu.
- Press to enter a sub-menu.
- Press to change the parameter displayed.
- Press to store the new value entered.

- Select the menu to enter.
- Select the sub-menu to enter.
- Scroll between parameters when in a specific menu or sub-menu.
- Increase a parameter value.
- Press to view the meter pages when the main display is shown.

- Select the menu to enter.
- Select the sub-menu to enter.
- Scroll between parameters when in a specific menu or sub-menu.
- Decrease a parameter value.
- Press to view the meters when the main display is shown.

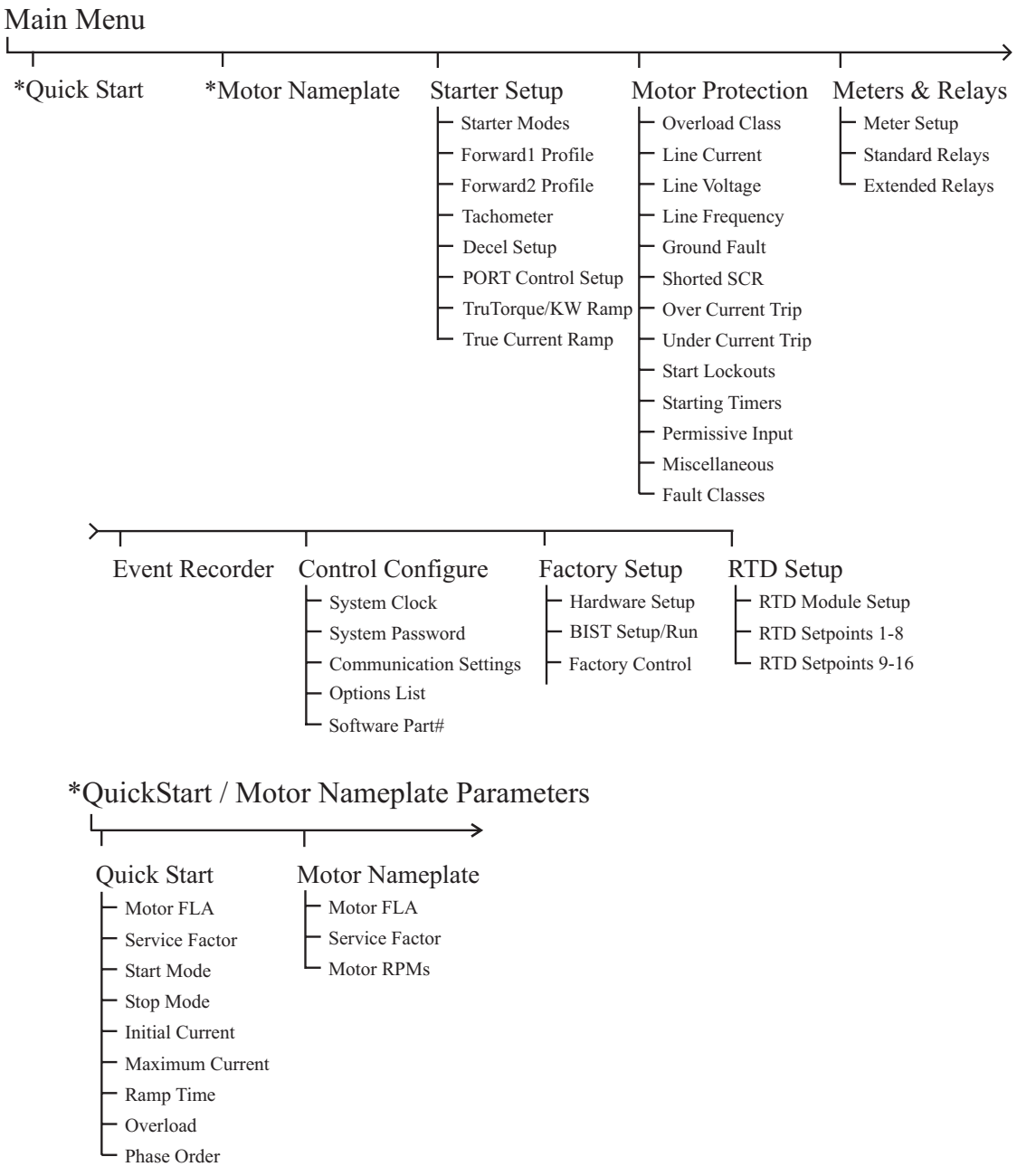
- Press to start the motor when the starter is connected for local display control.
- Press to activate the BIST (Built-In Self Test).
- If 2-wire control is used or the Start button is disabled, this button is inoperative.

- Press to stop the motor when the starter is connected for local display control.
- If 2-wire control is used or the Stop button is disabled, this button is inoperative.

Menu Structure

Menu Structure

The RediStart Micro II has a 2 level menu structure. There are eight main menus that contain parameters related to the different functions of the starter and five of the main menus contain additional sub-menus that divide the parameters into functional groups. The following shows the structure of the menu structure.



5.1 HOW TO PROGRAM

Viewing a Parameter

Viewing a Parameter

To access a specific parameter in the RediStart Micro II menu structure, follow these steps. Refer to the previous page for a graphical representation of the menu structure.

- Press the [Menu] button to enter the menu system.
- Press the [Up] or [Down] buttons to get the desired menu on the display.
- Press the [Enter] button to go into the menu.
- Press the [Up] or [Down] button to get to the desired sub-menu, if necessary.
- Press the [Enter] button to go into the sub-menu, if necessary.
- Press the [Up] or [Down] arrow buttons until the parameter is displayed.

Changing a Parameter

Changing a Parameter

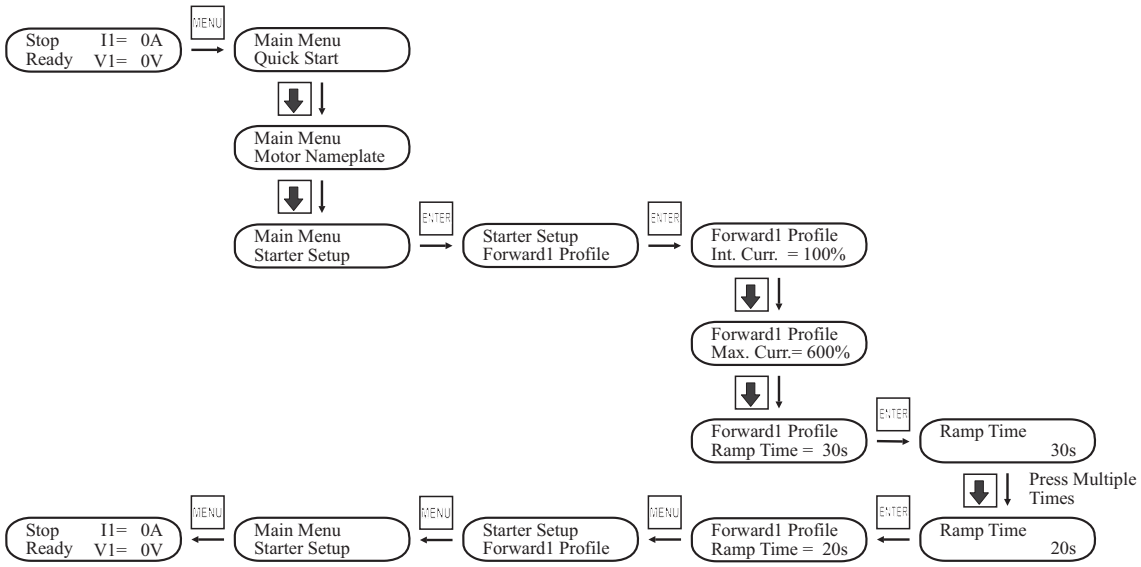
To change a parameter, follow these steps;

- View the desired parameter by following the Viewing a Parameter instructions.
- Press the [Enter] button to switch to the change parameter screen.
- Press the [Up] or [Down] buttons to get the desired value on the screen.
- Press the [Enter] button to store the new value.

An Example

The ramp time is set to 30 seconds and it is to be changed to 20 seconds.
The following steps must be taken to change the ramp time.

- Press the [Menu] button to enter the menu system.
- Press the [Down] button twice to get to the Starter Setup screen.
- Press the [Enter] button to access the Starter Setup menu.
- Press the [Down] button once to display the Forward1 Profile.
- Press the [Enter] button to access the Forward1 Profile sub-menu.
- Press the [Down] button twice to display the Ramp Time parameter.
- Press the [Enter] button to allow a change to the ramp time.
- Press the [Down] button repeatedly to change the Ramp Time to the desired value.
- Press the [Enter] button to store the value.
- Press the [Menu] button repeatedly to return to the main display.



Motor FLA

Description

The motor FLA parameter must be set to the full load amps of the motor connected to the starter for the starter to function correctly. If there is more than one motor connected, the motor FLA should be set to the sum of the connected motor full load amps.

⌘ **NOTE:** The starter uses the entered motor FLA for every current based calculation. If the motor FLA is not entered correctly, the current ramp profile and many of the starter's advanced protection features will not function properly.

Values

The motor FLA parameter is adjustable from 1 to 4000 amps in 1 amp increments.

Default

The default value for the motor FLA is 1 amp.

Serv. Fact (service factor)

Description

The service factor parameter should be set according to the service factor of the motor. The service factor is used for the overload calculations. See the motor overload curves on page 11 and page 154 for a detailed description of the overload operation. See resolving O/L trips on page 39-41 for Serv.Fact. programming guidelines..

Values

The service factor can be set from 1.00 to 1.99, in 0.01 increments.

⌘ **NOTE:** The NEC (National Electrical Code) does not allow the service factor to be set above 1.40. Check with other local electrical codes for their requirements.

Default

The default value for the service factor is 1.15.

Start Mode

Description

The Start Mode parameter allows for an optimal start of the motor based on the application. For a description of the possible Start Mode parameters, refer to page 31 in the Operations chapter.

Values

The Start Mode Parameter can be set to Curr, TT, Tach, or KW.

Default

The default value for the Start Mode is Curr.

Stop Mode

Description

The Stop Mode parameter allows for the most suitable stop of the motor based on the application. For a description of the possible Stop Mode parameters, refer to page 31 in the Operations chapter.

Values

The Stop Mode can be set to Coas, VDCL, or TT.

Default

The default value for the Stop Mode is Coas.

Int. Curr. (initial current)

Description

The initial current parameter is set as a percentage of the motor FLA parameter setting. The initial current parameter sets the current that will initially reach the motor when a start is commanded.

If the motor does not rotate within a few seconds after a start command, the initial current should be increased. If the motor takes off too quickly after a start command, the initial current should be decreased.

The initial current must be set to a value that is lower than the maximum current parameter setting.

A typical setting for the initial current parameter is from 50% to 175%.

Values

The initial current is adjustable from 50% to 400% in 1% intervals.

Default

The default value for the initial current is 100%.

Max. Curr. (maximum current)

Description

The maximum current parameter is set as a percentage of the motor FLA parameter setting. The maximum current parameter performs two functions. It sets the current for the end of the ramp profile. It also sets the maximum current that is allowed to reach the motor while the motor is being started.

If the ramp time expires before the motor has reached full speed, the starter will hold the current at the maximum current level until the UTS timer expires, the motor reaches full speed, or the overload trips.

Typically, the maximum current is set to 600% unless the power system or load dictates the setting of a lower maximum current.

Values

The maximum current is adjustable from 100% to 600% in 1% intervals.

Default

The default value for the maximum current is 600%.

Ramp Time

Description

The ramp time sets the amount of time that it takes for the starter to linearly increase the current from the initial current level to the maximum current level.

A typical ramp time setting is from 15 to 30 seconds.

Settings

The ramp time is adjustable from 0 to 120 seconds in 1 second intervals.

Default

The default value for the ramp time is 15 seconds.

Overload

Description

The overload parameter sets the class of the electronic overload. One of the forty standard overload curves may be programmed based on the manufacturer's locked rotor time capability. The starter stores the thermal overload value as a percentage value between 0 and 100%, with 0% representing a “cold” overload and 100% representing a tripped overload. See page 11 for the overload trip time vs current curves.

Values

Class 1 to 40 in steps of 1.

Default

The default value for the overload parameter is 10.

Phase Order (phase order)

Description

The line phasing parameter sets the phase sensitivity of the starter. This can be used to protect the motor from a possible change in the incoming phase sequence. If the incoming phase sequence does not match the set phase rotation, the starter will display **ph err** while stopped and will fault if a start is attempted.

Values

The line phasing can be set to;

- INS - will run with either phase sequence
- ABC - will only run with ABC phase sequence
- CBA - will only run with CBA phase sequence

Default

The default value for the phase sensitivity parameter is INS.

5.3 MOTOR NAMEPLATE

Motor FLA

Description

The motor FLA parameter must be set to the full load amps of the motor connected to the starter for the starter to function correctly. If there is more than one motor connected, the motor FLA should be set to the sum of the connected motor full load amps.

⌘ **NOTE:** The starter uses the entered motor FLA for every current based calculation. If the motor FLA is not entered correctly, the current ramp profile and many of the starter's advanced protection features will not function properly.

Values

The motor FLA parameter is adjustable from 1 to 4000 amps in 1 amp increments.

Default

The default value for the motor FLA is 1 amp.

Serv. Fact (service factor)

Description

The service factor parameter should be set according to the service factor of the motor. The service factor is used for the overload calculations. See the motor overload parameter on page 11 for a detailed description on how to set the service factor for different applications to avoid overload trips. See resolving O/L trips on page 39-41 for Serv.Fact. programming guidelines.

Values

The service factor can be set from 1.00 to 1.99, in 0.01 increments.

⌘ **NOTE:** The NEC (National Electrical Code) does not allow the service factor to be set above 1.40. Check with other local electrical codes for their requirements.

Default

The default value for the service factor is 1.15.

Motor RPMs (motor ramps per minute)

Description

The Motor RPMs can be set to match the RPM rating of the motor.

Values

The Motor RPMs can be set from 1 to 3600 RPM's in increments of 1.

Default

The default value for the Motor RPMs is 1760.

Start Mode

Description The Start Mode parameter allows for an optimal start of the motor based on the application. For a description of the possible Start Mode parameters, refer to page 31 in the Operations chapter.

Values The Start Mode Parameter can be set to Curr, TT, Tach, or KW.

Default The default value for the Start Mode is Curr.

Stop Mode

Description The Stop Mode parameter allows for the most suitable stop of the motor based on the application. For a description of the possible Stop Mode parameters, refer to page 31 in the Operations chapter.

Values The Stop Mode can be set to Coas, VDCL, or TT.

Default The default value for the Stop Mode is Coas (coast).

Int. Curr. (initial current)

Description

The initial current parameter is set as a percentage of the motor FLA parameter setting. The initial current parameter sets the current that will initially reach the motor when a start is commanded.

If the motor does not rotate within a few seconds after a start command, the initial current should be increased. If the motor takes off too quickly after a start command, the initial current should be decreased.

The initial current must be set to a value that is lower than the maximum current parameter setting.

A typical setting for the initial current parameter is from 50% to 175%.

Values

The initial current is adjustable from 50% to 400% in 1% intervals.

Default

The default value for the initial current is 100%.

Max. Curr. (maximum current)

Description

The maximum current parameter is set as a percentage of the motor FLA parameter setting. The maximum current parameter performs two functions. It sets the current for the end of the ramp profile. It also sets the maximum current that is allowed to reach the motor while the motor is being started.

If the ramp time expires before the motor has reached full speed, the starter will hold the current at the maximum current level until the stall time expires, the motor reaches full speed, or the overload trips.

Typically, the maximum current is set to 600% unless the power system or load dictates the setting of a lower maximum current.

Values

The maximum current is adjustable from 100% to 600% in 1% intervals.

Default

The default value for the maximum current is 600%.

Ramp Time

Description

The ramp time sets the amount of time that it takes for the starter to linearly increase the current from the initial current level to the maximum current level.

A typical ramp time setting is from 15 to 30 seconds.

Settings

The ramp time is adjustable from 0 to 120 seconds in 1 second intervals.

Default

The default value for the ramp time is 15 seconds.

Kick Curr. (kick current)

Description

The kick current parameter is set as a percentage of the motor FLA parameter setting. The kick current sets a current level that overrides the current ramp profile, for the set kick time, when a start is commanded. If a kick time is programmed, the starter will provide the current level specified by the kick current setting for this set time. This current can be used to overcome the break over torque of some loads, while still allowing the starter to smoothly accelerate the load to full speed.

Values

The kick current is adjustable from 100% to 600% in 1% increments.

Default

The default value for the kick current is 300%.

Kick Time

Description

The kick time parameter sets the amount of time that the kick current level is provided to the motor when a start is commanded.

If the kick time is set to any time other than Off, the starter will provide the kick current level for the set time. The kick time should be increased or decreased to reach the time required to begin rotating the load.

Values

The kick time is adjustable from 0.1 to 10.0 seconds in 0.1 second intervals. If a kick current is not required, the kick time should be set to Off.

Default

The default value for the kick time is Off.

5.6 STARTER SETUP - FORWARD2 PROFILE

Forward #2 Ramp Profile

General

The forward #2 ramp profile sub-menu contains the parameters that set the starting ramp profile when the second ramp is selected. The second ramp is selected by applying 120VAC to input 9 of the JC13 terminal block on the RediStart Micro II CPU card.

Int. Curr. (initial current)

Description

The initial current parameter is set as a percentage of the motor FLA parameter setting. The initial current parameter sets the current that will initially reach the motor when a start is commanded.

If the motor does not rotate within a few seconds after a start command, the initial current should be increased. If the motor takes off too quickly after a start command, the initial current should be decreased.

The initial current must be set to a value that is lower than the maximum current parameter setting.

A typical setting for the initial current parameter is from 50% to 175%.

Values

The initial current is adjustable from 50% to 400% in 1% intervals.

Default

The default value for the initial current is 100%.

Max. Curr. (maximum current)

Description

The maximum current parameter is set as a percentage of the motor FLA parameter setting. The maximum current parameter performs two functions. It sets the current for the end of the ramp profile. It also sets the maximum current that is allowed to reach the motor while the motor is being started.

If the ramp time expires before the motor has reached full speed, the starter will hold the current at the maximum current level until the stall time expires, the motor reaches full speed, or the overload trips.

Typically, the maximum current is set to 600% unless the power system or load dictates the setting of a lower maximum current.

Values

The maximum current is adjustable from 100% to 600% in 1% intervals.

Default

The default value for the maximum current is 600%.

Ramp Time

Description

The ramp time sets the amount of time that it takes for the starter to linearly increase the current from the initial current level to the maximum current level.

A typical ramp time setting is from 15 to 30 seconds.

Settings

The ramp time is adjustable from 0 to 120 seconds in 1 second intervals.

Default

The default value for the ramp time is 15 seconds.

Kick Curr. (kick current)

Description

The kick current parameter is set as a percentage of the motor FLA parameter setting. The kick current sets a current level that overrides the current ramp profile, for the set kick time, when a start is commanded. If a kick time is programmed, the starter will provide the current level specified by the kick current setting for this set time. This current can be used to overcome the break over torque of some loads, while still allowing the starter to smoothly accelerate the load to full speed.

Values

The kick current is adjustable from 100% to 600% in 1% increments.

Default

The default value for the kick current is 300%.

Kick Time

Description

The kick time parameter sets the amount of time that the kick current level is provided to the motor when a start is commanded.

If the kick time is set to any time other than Off, the starter will provide the kick current level for the set time. The kick time should be increased or decreased to reach the time required to begin rotating the load.

Values

The kick time is adjustable from 0.1 to 10.0 seconds in 0.1 second intervals. If a kick current is not required, the kick time should be set to Off.

Default

The default value for the kick time is Off.

FS Volts (full speed volts)

Description The FS Volts parameter sets the tachometer input voltage at full speed. This value should be set at full (unloaded) motor speed.

For example: A tachometer rated at 0.0033 volts-per-rpm is mounted on a 4-pole 1800 rpm motor. Therefore, the FS Volts should be set to: 0.0033 x 1800 = 5.94 volts.

Values The tachometer FS Volts value can be set between 1.00 and 7.00 volts in 0.01 increments.

Default The default value for the tachometer FS Volts value is 5.00 volts.

Stab Cnst (stability constant)

Description The Stab Cnst parameter is used to control the speed and bandwidth of the speed controller.

⌘ **NOTE:** Lower values slow down the controller's response, which is useful if the system has a large inertia and/or low stiffness. Higher values will speed up the controller's response, which can be useful if the more precise speed control is necessary. If the stability constant is set too low, the starter will not track the speed reference properly and the motor speed profile will not be linear.

Values The Stab Cnst parameter is adjustable from 10% to 150% in 1% increments.

Default The default value for the Stab Cnst parameter is 100%.

Ramp#1 Tim (ramp #1 time)

Description The ramp #1 time sets the amount of time that it takes for the starter to linearly accelerate the motor from zero speed to full speed.

Values The Ramp#1 Tim is adjustable from 0 to 120 seconds in 1 second intervals. The Ramp#1 Tim can also be set to Off.

Default The default value for the Ramp#1 Tim is 15 seconds.

Ramp#2 Tim (ramp #2 time)

Description The ramp #2 time sets the amount of time that it takes for the starter to linearly accelerate the motor from zero speed to full speed when Ramp #2 is selected.

Values The Ramp#2 Tim is adjustable from 0 to 120 seconds in 1 second intervals. The Ramp#2 Tim can also be set to Off.

Default The default value for the Ramp #2 Tim is 15 seconds.

TLoss Dly (tachometer signal loss delay)

Description

The TLoss Delay time is the allowable time the starter will operate when a tachometer signal is lost. If the signal is lost, the starter will perform the action set by the TLoss Mode parameter.

⌘ **NOTE:** Nuisance tachometer loss faults at start can be prevented by setting the initial current parameter to a value that allows the motor to begin rotating soon after a start is commanded.

Values

The TLoss Delay time parameter is adjustable from 0.1 seconds to 90.0 seconds in 0.1 second intervals.

Default

The default value for the TLoss Delay time is 1.5 seconds.

TLoss Mode (tachometer signal loss mode)

Description

The TLoss Mode determines the starter's action if it has been detected the tachometer signal is lost.

⌘ **NOTE:** If Current ramp or TruTorque ramp is selected, all values within these ramp profiles must be set for proper operation.

⌘ **NOTE:** If Current ramp or TruTorque ramp is selected, and the tachometer signal is lost, the starter will shut down and automatically restart with the new starting mode. The new start mode will apply until a manual reset to Tach is performed.

Values

The TLoss Mode parameter can be set to Shut (shutdown), Curr (Current Ramp), or TT (TruTorque Ramp).

Default

The default value for the TLoss Mode is Shut.

5.8 STARTER SETUP - DECEL SETUP

V Level #1

Description

The V Level #1 parameter sets the starting voltage for the voltage ramp deceleration ramp profile.

The deceleration profile uses an open loop voltage ramp profile. The decel level #1 parameter sets the starting point on the S curve. This means that decel level #1 is not set as a percentage of actual line voltage.

If the motor initially surges when a stop is commanded, decrease this parameter value. If there is a sudden drop in motor speed when a stop is commanded, increase this parameter value.

A typical decel level #1 setting is between 30% and 40%.

Values

The decel level #1 is adjustable from 10% to 100% in 1% increments. The decel level #1 setting must be greater than the decel level #2 setting.

Default

The default value for the decel level #1 parameter is 40%.

V Level #2

Description

The V Level #2 parameter sets the ending voltage for the voltage ramp profile. Decel level #2 can not be set greater than decel level #1.

The deceleration profile uses an open loop voltage ramp profile. The decel level #2 parameter sets the ending point on the S curve. This means that decel level #2 is not set as a percentage of actual line voltage.

If the motor stops rotating before the deceleration time has expired, increase this parameter value. If the motor is still rotating when the deceleration time has expired, decrease this parameter value. A typical decel level #2 setting is between 10% and 20%.

Values

The decel level #2 parameter is adjustable from 1% to 99% in 1% increments. The decel level #2 must be less than the decel level 1 setting.

Default

The default value for the decel level #2 parameter is 20%.

V DCL Time (decel time)

Description

The V DCL Time parameter sets the amount of time taken to go from the decel level #1 setting to the decel level #2 setting.

If the motor stops rotating before the decel time has expired, decrease the decel time. If the motor is still rotating when the decel time expires, increase the decel time.

A typical decel time setting is 20 to 40 seconds.

Values

The decel time parameter is adjustable from 0 to 60 seconds in 1 second intervals.

Default

The default value for the decel time parameter is 0 seconds.

TT DCL Tim (trutorque deceleration time)

Description

The TruTorque deceleration time sets how quickly the motor decelerates. Usually a time of 30 seconds is a good starting point. To make the motor decelerate at a slower rate increase this time or to make the motor stop quicker decrease this time.

Values

The TruTorque deceleration time parameter is adjustable from 0 to 100 seconds in 1 second intervals

Default

The default TruTorque deceleration time is 0 seconds.

TT DCL Tor (trutorque ending deceleration torque)

Description

The value sets the final torque level for the TruTorque deceleration ramp. In most cases, this parameter can be set to 10%.

To adjust this parameter, it is necessary to observe the motor. If the motor is coming to a stop too quickly or if the starter continues to apply current to the motor after the motor has stopped this parameter can be increased in 5% increments.

If the motor is still rotating when the desired deceleration time has expired, decrease this parameter by 5% and retest.

Values

The TruTorque deceleration ending torque value can be set from 1% to 100% torque in 1% steps.

Default

The default TruTorque deceleration ending torque setting is 10%

Fault Dly (Fault Delay)

Description

The Fault Dly parameter determines how long a power disturbance can exist before the micro system will fault out on a power loss; and no longer restart. If the Fault Dly parameter is set to OFF, the PORT detection will be disabled and the standard motor protection features will be enabled.

⌘ **NOTE**: Caution must be taken when the BYP Dly is set above 0.0 seconds. If the bypass contactor is energized when the power disturbance ends, the motor will start across the line. The resulting torque may damage the system.

⌘ **NOTE**: Consult factory for application assistance.

Values

The Fault Dly parameter is adjustable from OFF, 0.1 through 90.0 seconds in 0.1 second intervals.

Default

The default value for the Fault Dly parameter is OFF.

Bypass Dly (Bypass Delay)

Description

The Bypass Dly parameter determines when the bypass contactor will drop after a power disturbance is sensed.

Values

The Bypass Dly parameter is adjustable from OFF, 0.0 through 3.0 seconds in 0.1 second intervals.

⌘ **NOTE:** Caution must be taken when the BYP Dly is set above 0.0 seconds. If the bypass contactor is energized when the power disturbance ends, the motor will start across the line. The resulting torque may damage the system (consult factory for application assistance).

Default

The default value for the Bypass Dly time is 0.0 seconds.

Sense Time

Description

The Sense Time parameter determines how long a power outage must exist before the micro will drop to a coast to stop, and wait for a valid line voltage before restarting.

Values

The Sense Time parameter is adjustable from 0.01 through 0.50 seconds in 0.01 second intervals.

Default

The default value for the Sense Time parameter is 0.05 seconds.

Int Tor/KW (initial torque or power)

Description

This is a dual application parameter.

When using TruTorque control this parameter sets the initial torque level that the motor will produce during starting.

When using KW (power) control this parameter sets the initial power consumption reference that will be allowed when the motor starts.

This parameter should be set to a level that allows the motor to begin to accelerate with a few seconds of a start command being received.

⌘ **NOTE:** In both cases it is important that the Motor Rated PF parameter is set properly so that this parameter is scaled properly with respect to the motor characteristics.

Values

1% to 100% in 1% increments.

Default

The default value is 20%.

Max Tor/KW (maximum torque or power)

Description

This is a dual application parameter.

When using TruTorque control this parameter sets the final or maximum torque level that the motor will produce at the end of the ramp time during starting. For a loaded motor, the maximum torque parameter initially should be set to 100% or greater. If the maximum torque value is set too low, the motor may not produce enough torque to reach full speed (UTS). On lightly loaded motors this parameter may be reduced below 100% to provide for smoother starts.

When using KW (power) control this parameter sets the final or maximum power value consumption reference that will be achieved at the end of the ramp time. If the maximum power value is set too low the motor may not produce enough torque to reach full speed (UTS).

⌘ **NOTE:** In both cases it is important that the Motor Rated PF parameter is set properly so that this parameter is scaled properly with respect to the motor characteristics.

Values

10% to 325% in 1% increments.

Default

The default value 105%.

Ramp Time

Description

The ramp time parameter sets the time it takes for the commanded torque to go from the Initial Torque Setting to the Maximum Torque Setting or from the initial power setting to maximum power setting. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

If the ramp time expires before the motor reaches full speed the starter will maintain the set Maximum Torque level until either the motor reaches full speed, the stall (UTS) timer expires, or the motor thermal overload trips.

⌘ **NOTE:** This ramp time setting is only used for TruTorque or KW (power) starts. It is not the same ramp time parameter that is used for current ramp profile starts.

⌘ **NOTE:** Setting the ramp time to a specific value does not necessarily mean that the motor will take this time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum torque to reach full speed. Alternatively, the motor and load may take longer than the set ramp time to achieve full speed.

Values

The TruTorque/KW ramp time is adjustable from 0 to 120 seconds in 1 second intervals.

Default

The default value for the TruTorque/KW ramp time is 15 seconds.

5.10 STARTER SETUP - TRUTORQUE/KW RAMP

TT/KW O Cu (trutorque/KW overcurrent trip)

Description This parameter is used to set an upper current limit during a TruTorque or KW power control acceleration ramp. If the motor current remains above this level for longer than the delay time the starter will trip. In order to protect applications such as pumps from water hammer if an overcurrent fault occurs a normal deceleration profile will still occur to gracefully shut down the system before the TruTorque/KW overcurrent Fault is displayed and the starter disabled.

⌘ **NOTE:** The TruTorque / KW ramp overcurrent trip only operates during TruTorque or KW acceleration ramping before the starter has indicated an up-to-speed (UTS) condition. If overcurrent protection is desired after the motor has come up-to-speed the Over Current parameter under the Motor Protection menu must be used.

Values Off or 100% to 800% of FLA in 1% increments.

Default The default value is Off.

Ovr Cur Dl (trutorque overcurrent trip delay)

Description The TruTorque overcurrent trip delay parameter sets the time that the motor current must exceed the TruTorque Overcurrent Trip setting, while the starter is ramping, before a trip will occur.

Values The TruTorque overcurrent delay parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default The default value for the TruTorque overcurrent delay parameter is 0.1 seconds.

Rated M PF (rated motor power factor)

Description: This parameter is used during TruTorque control and Kilowatt power control to adjust the control algorithm scaling based on the actual motor rated power factor. It is also used to properly scale the %TT and %KW output meters. If using either one of these control options for acceleration or deceleration control, it is very important to set this parameter to the correct rated motor power factor (usually available on the motor nameplate). For most motors this value is between 0.80 and 0.95.

Values: 0.00 lagging to 1.00 unity in 0.01 steps.

Default: The default value is 0.92 lagging.

Overload

Description

The overload parameter sets the class of the electronic overload. One of the forty standard overload curves may be programmed based on the manufacturer's locked rotor time capability. The starter stores the thermal overload value as a percentage value between 0 and 100%, with 0% representing a “cold” overload and 100% representing a tripped overload. See page 12 for the overload trip time vs current curves.

Values

Class 1 to 40 in steps of 1.

Default

The default value for the overload parameter is 10.

% Imbalanc (percent imbalance)

Description

The percent imbalance parameter sets the allowable phase to average current difference that is allowed before the starter will shut down. The current imbalance must exist for the amount of time set by the imbalance delay time before this will occur.

The current imbalance for each phase is calculated as the percentage difference between the phase current and the average current. The equation for the current imbalance is;

$$\%\ \text{imbalance} = \frac{I_{ave} - I_{phase}}{I_{ave}} \times 100\%$$

If the highest calculated current imbalance is greater than the current imbalance level, the starter will shut down the motor and display a fault 23 to fault 28 depending on the phase that has the out of range current.

Values

The percent imbalance is adjustable from 10 to 40% in 1% increments.

Default

The default value for the percent imbalance is 15%.

Imbal Dela (imbalance delay)

Description

The imbalance delay parameter sets the time that the current imbalance must be greater than the percent imbalance parameter before a trip will occur.

Values

The imbalance delay parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the imbalance delay parameter is 0.5 seconds.

@ Stop Dly (current at stop delay)

Description

The current at stop delay parameter sets the time that a phase current must be greater than 5% of the motor FLA parameter, before a trip will occur.

Fault Code 52 - Curr. at Stop will be displayed when this fault occurs.

Values

The current at stop delay parameter can be set from 0.1 to 10.0 seconds in 0.1 second intervals

Default

The default value for the current at stop delay parameter is 1.5 seconds.

% No C@Run (percent no current at run)

Description

The percent no current at run parameter sets a low current operating level. If the current falls below this level, the RediStart Micro II will shut down the starter and give a no current at run fault. This level is set as a percentage of the motor full load amps. The current must remain below this parameter setting for the no current at run delay time before a fault will occur.

Fault Code 53 - No Curr at Run will be displayed when this fault occurs.

⌘ **NOTE:** High speed (2-pole) and premium/high efficiency motors may require the % No C @ Run to be reduced.

Values

The percent no current at run parameter can be set from 2 to 40% in 1% increments.

Default

The default value for the percent no current at run parameter is 5%.

No C@R Dly (no current at run delay)

Description

The no current at run delay parameter sets the time that the motor current must be less than the percent no current at run parameter setting, before a trip will occur.

Values

The no current at run parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the no current at run parameter is 1.0 seconds.

5.13 MOTOR PROTECTION - LINE VOLTAGE

H/L Volts (high/low voltage)

Description

The high/low voltage trip sets the allowable operating voltage range. If the voltage on any line goes outside of the allowable operating range, the starter will shut down and give a high or low line fault.

The low and high voltage trip points are calculated as follows;

$$V_{low} = V_{base} - V_{base} \times (\text{Parameter} \div 100)$$
$$V_{high} = V_{base} + V_{base} \times (\text{Parameter} \div 100)$$

The base voltage (V_{base}) used for the calculations is selected by setting jumpers JPC17 and JPC18 on the RediStart Micro computer card. Refer to the jumper settings on page 13 for information on setting these parameters.

The line voltage must be out of the specified range for the time specified by the delay time parameter before the starter will trip.

Fault Code 17-22 will be displayed when this fault occurs, depending on which line goes high or low.

Values

The high/low voltage is adjustable from 10 to 30% in 1% increments.

Default

The default value for the high/low voltage parameter is 20%.

Delay Time

Description

The delay time parameter sets the time that the line voltage must go outside of the voltage range set by the high/low voltage parameter before a high or low voltage trip will occur.

This parameter may be lengthened to allow for temporary voltage fluctuations outside of the allowable voltage range. If the time is extended, the control voltage must be monitored to ensure it remains within acceptable limits. If the control voltage is fluctuating, an un-interruptible power supply should be used.

Values

The voltage delay parameter is adjustable from 0.1 to 3.0 seconds in 0.1 second intervals.

Default

The default value for the voltage delay parameter is 0.5 seconds.

PH Dect Dl (phase detect delay)

Description

The phase detect delay parameter sets the delay time on Fault #56: “Phase Detection.” This fault detects a loss of proper phase timing even when the phase code remains valid; example: loss of line when the motor back generates a voltage. This allows a much faster detection than low line or no current at run faults.

Fault Code 56 - Phase Detection will be displayed when this fault occurs.

Values

The PH Dect Dl parameter is adjustable from 0.3 to 5.0 seconds in 0.1 second intervals.

Default

The default value for the PH Dect Dl parameter is 0.8 seconds.

High Freq. (high frequency)

Description

The high frequency parameter sets the highest line frequency that the starter will operate on.

When operating on line power, the default setting will usually suffice. If the application is speed sensitive, or the line power is suspect, the high frequency parameter can be set to the highest acceptable frequency. When operating on generator power, the high frequency parameter should be set to the highest acceptable frequency. This will ensure that a generator problem will not cause unnecessarily large fluctuations in the speed of the motor.

The frequency must be above the high frequency setting for the frequency delay parameter before the starter will recognize a high frequency condition. Once a high frequency condition exists, the starter will shut down and display a fault 4, High Freq. Trip.

Values

The high frequency trip is adjustable from 72 to 24hz in 1hz increments.

Default

The default value for the high frequency trip parameter is 72hz.

Low Freq. (low frequency)

Description

The low frequency parameter sets the lowest line frequency that the starter will operate on.

When operating on line power, the default setting will usually suffice. If the application is speed sensitive, or the line power is suspect, the low frequency parameter can be set to the lowest acceptable frequency. When operating on generator power, the low frequency parameter should be set to the lowest acceptable frequency. This will ensure that a generator problem will not cause unnecessarily large fluctuations in the speed of the motor.

The frequency must be below the low frequency setting for the frequency delay parameter before the starter will recognize a low frequency condition. Once a low frequency condition exists, the starter will shut down and display a fault 5, frequency < Low Freq. Trip.

Values

The low frequency trip is adjustable from 23 to 71hz in 1 Hz intervals.

Default

The default value for the low frequency trip parameter is 23hz.

Freq Delay (frequency delay)

Description

The frequency delay parameter sets the time that the line frequency must go above the high frequency trip point or below the low frequency trip parameter before a high or low frequency fault will occur.

Values

The frequency delay parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the frequency delay parameter is 0.1 seconds.

5.15 MOTOR PROTECTION - GROUND FAULT

GND Fault (ground fault)

Description

The ground fault parameter sets a ground fault current trip or indicate level that can be used to protect the system from a ground fault condition.

The starter monitors the instantaneous sum of the three line currents to detect the ground fault current. **This is often referred to as residual ground fault protection. This type of protection is meant to provide machine ground fault protection only. It is not meant to provide human ground fault protection.**

The ground fault current has to remain above the ground fault level for the ground delay parameter time before the starter will recognize a ground fault condition. Once the starter recognizes a ground fault condition, it will shut down the motor and display a fault 71-Ground Fault. If a programmable relay is set to ground fault (GND), the starter will energize the relay when the condition exists.

If it is desired to have the starter continue to operate after a ground fault is detected, enter the fault classes menu (see page 76) and change the classification of fault 71 to either Dis, WrnA, WrnB, or WrnC.

A typical value for the ground fault current setting is 10% to 20% of the full load amps of the motor.

Values

The ground fault is adjustable from 1 to 100 amps in 1 amp increments. The ground fault current can also be set to Off by setting it below 1 amp.

Default

The default value for the ground fault parameter is Off.

GND Delay (ground delay)

Description

The ground delay parameter sets the period of time that the ground fault current must be above the ground fault current setting before a ground fault trip will occur.

Values

The ground delay parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the ground delay parameter is 1.0 seconds.

@ Ramp DLY (shorted SCR at ramp delay)

Description

The shorted SCR at ramp parameter sets the period of time that there must be a current imbalance of more than 50%, while the starter is accelerating, before a shorted SCR fault occurs.

Fault Code 92-97 will be displayed when this fault occurs depending on which line(s) are imbalanced.

Values

The shorted SCR at ramp parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the shorted SCR at ramp parameter is 0.2 seconds.

@ Stop DLY (shorted SCR at stop delay)

Description

The shorted SCR at stop parameter sets the period of time that there must be a current flow of more than 50% of the motor FLA value, while the motor is stopped, before a shorted SCR fault will occur.

Fault Code 92-97 will be displayed when this fault occurs depending on which line(s) are imbalanced.

Values

The shorted SCR at stop parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the shorted SCR at stop parameter is 1.0 seconds.

5.17 MOTOR PROTECTION - OVER CURR. TRIP

Current (overcurrent trip)

Description

The overcurrent parameter is set as a percentage of the motor FLA parameter. It sets a high current trip or indicate level that can be used to protect the system from an overloaded condition.

The motor current has to remain above the current setting for the delay time parameter before the starter will recognize an over current condition.

Fault code 78 - Over Curr Trip will be displayed when this fault occurs.

⌘ **NOTE:** The overcurrent parameter does not become active until after the starter has reached full speed.

Values

The current is adjustable from 50 to 800%, in 1% increments. The current can also be set to Off by going above 800%.

Default

The default value for the current parameter is Off.

Detect Dly (detect delay)

Description

The detect delay time parameter sets the period of time that the motor current must be greater than the over current level before an overcurrent trip will occur.

Values

The detect delay time can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the detect delay time parameter is 0.1 second.

Release Dl (release delay)

General

The release delay time sets how long the relay is energized after the over current condition is cleared. This parameter is only functional if a relay has been programmed to OCT (over current trip) in the relay sub-menu (see page 79).

Values

The release delay time parameter can be set from 1.0 to 90.0 seconds in 0.1 second intervals

Default

The default value for the release delay time parameter is 10.0 seconds.

Current (undercurrent trip)

Description

The undercurrent parameter is set as a percentage of the motor FLA parameter. It sets a low current trip or indicate level and can be used to protect the system from an unloaded condition. The under current protection is especially useful to protect a pump. The motor current will fall when the pump becomes unloaded and the under current protection can be used to shut down the motor or warn of this unloaded condition.

Fault code 79 - Under Curr Trip will be displayed when this fault occurs.

The motor current has to remain below the under current setting for the under current delay time parameter before the starter will recognize an under current condition.

⌘ **NOTE:** The undercurrent parameter does not become active until after the starter has reached full speed.

Values

The current is adjustable from 10 to 100% in 1% increments. The current can also be set to Off by going below 10%

Default

The default value for the current parameter is Off.

Detect Dly (detect delay)

Description

The detect delay time parameter sets the period of time that the motor current must be less than the current level before an under current trip will occur.

Values

The detect delay time parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default

The default value for the detect delay time parameter is 0.1 seconds.

Release Dl (release delay)

General

The release delay time sets how long the relay is energized after the under current condition is cleared. This parameter is only functional if a relay has been programmed to UCT (under current trip) in the relay sub-menu (see page 79).

Values

The release delay time parameter can be set from 1.0 to 90.0 seconds in 0.1 second intervals

Default

The default value for the release delay time parameter is 10.0 seconds.

5.19 MOTOR PROTECTION - START LOCKOUTS

Starts/Hou (starts per hour)

Description

The starts per hour parameter will set the number of allowed starts in one hour. If the starter has been stopped and the number of starts given in the last hour has exceeded this setting, the starter will display SPH hold in the top left of the display and the time, in minutes, until the next start is allowed in the bottom left of the display. If another start is attempted, the starter will go into a fault condition and show SPH Loc and the time in minutes until the next start is allowed.

⌘ **NOTE:** Consult motor manufacturer for specified starts per hour.

⌘ **NOTE:** Starts/Hou does not increment on a PORT restart.

Values

The starts per hour is adjustable from 1 to 20 starts, in 1 start intervals. The starts per hour can also be set to Off by going below 1.

Default

The default value for the starts per hour parameter is Off.

Time Start (time between starts)

Description

The time between starts parameter sets the minimum allowed time between starts. Once a start command has been given, the next start cannot be performed until this time has expired. If the starter is stopped and the time between starts has yet to expire, the starter will display TBS hld in the top left of the display and the time, in minutes, until the next start is allowed in the bottom left of the display. If another start is attempted, the starter will go into a fault condition and show TBS Loc and the time in minutes until the next start is allowed

⌘ **NOTE:** Consult motor manufacturer for specified time between starts.

⌘ **NOTE:** Time Start does not increment on a PORT restart.

Values

The time between starts is adjustable from 1 to 600 minutes, in 1 minute intervals. The time between starts can also be set to Off by going below 1 minute.

Default

The default value for the time between starts parameter is 10 minutes.

BKS Timer (backspin timer)

Description

The backspin timer parameter sets the minimum time between a stop and the next allowed start. If the starter is stopped and a time has been set, the starter will display BKS hld in the top left of the display and the time, in minutes, until the next allowed start in the bottom left. If another start is attempted, the starter will go into a fault condition and show BKS Loc and the time in minutes until the next start is allowed

⌘ **NOTE:** The BKS Timer does not increment on a PORT restart.

Values

The backspin timer is adjustable from 1 to 200 minutes, in 1 minute intervals. The backspin timer can also be set to Off by going below 1 minute.

Default

The default value for the backspin timer parameter is Off.

UTS Timer (up-to-speed timer)

Description

The up-to-speed timer parameter sets the max time for the motor to accelerate to full speed. A stalled motor condition will be detected if the motor does not get up-to-speed before the up-to-speed timer expires. The motor is considered up-to-speed once the current stabilizes below 175 percent of the FLA value and the ramp time expires.

⌘ **NOTE:** The up-to-speed timer has to be set to a time that is greater than the highest ramp time in use. The up-to-speed timer will not automatically change to be greater than the ramp time. If a ramp time greater than the up-to-speed timer is set, the starter will display an up-to-speed fault every time a start is attempted.

Fault Code 74 - Up to Speed Fault will be displayed when a stalled motor condition is detected.

Values

The up-to-speed timer parameter can be set from 1 to 300 seconds. The up-to-speed timer can be set to Off by setting it below 1 second.

Default

The default value for the up-to-speed timer parameter is 30 seconds.

Zero Speed

Description

When using the zero speed stall protection, the starter will start monitoring the zero speed input (at JC13-8) as soon as a run command is given and will recognize a stalled motor if the zero speed time has elapsed before the zero speed signal is removed. The zero speed input requires a 120VAC signal to indicate the zero speed condition.

Fault Code 69 - Zero Speed Timer will be displayed when a stalled motor condition is detected.

Values

The zero speed parameter can be set from 1 to 30 seconds, The zero speed timer can be set to Off by setting it below 1 second.

Default

The default value for the zero speed parameter is Off.

5.21 MOTOR PROTECTION - PERMISSIVE INPUT

Inline

Description The starter has a 120VAC feedback input from the inline contactor. It uses this feedback to check that the contactor is energized when it should be. This time is the delay before a fault will occur.

Values The inline delay time is adjustable from 1 to 10 seconds in 1 second intervals.

Default The default value for the inline parameter is 4 seconds.

Bypass

Description The starter has a 120VAC feedback input from the bypass contactor. It uses this feedback to check that the contactor is energized when it should be. This time is the delay before a fault will occur.

Values The bypass time is adjustable from 1 to 10 seconds in 1 second intervals.

Default The default value for the bypass parameter is 4 seconds.

Trip Input

Description The trip input parameter sets the time that power must be removed from the 120VAC input at JC13 terminal #1 on the RediStart Micro II CPU card before a fault occurs. When an external fault occurs, the starter will shut down and display a Fault 75 - External Fault.

Values The trip input parameter can be set from 0.1 to 90.0 seconds in 0.1 second intervals.

Default The default value for the trip input parameter is 0.5 seconds.

Phase Orde (phase order)

Description

The line phasing parameter sets the phase sensitivity of the starter. This can be used to protect the motor from a possible change in the incoming phase sequence. If the incoming phase sequence does not match the set phase rotation, the starter will display **ph err** while stopped and will fault if a start is attempted.

Fault Code 1 or 2 - Not ABC or Not CBA will be displayed when this condition occurs.

Values

The line phasing can be set to;

- INS - will run with either phase sequence
- ABC - will only run with ABC phase sequence
- CBA - will only run with CBA phase sequence

Default

The default value for the phase sensitivity parameter is INS.

Auto RST (number of auto resets)

Description

The number of auto resets parameter sets how many times in one hour the RediStart Micro II will reset a non-critical fault.

This parameter is used in conjunction with the automatic fault reset jumper JPC19 (see page 24) and with the fault classes sub-menu (see page 76). When JPC19 is placed in the automatic fault reset position (1-2), this parameter sets how many times in one hour any non-critical faults are reset before a manual reset is required. Non-critical faults are set in the fault classes sub-menu (see page 76).

⌘ **NOTE:** Consult motor manufacturer for the specified starts/hour.

Values

The number of auto resets parameter can be set from 1 to 5.

Default

The default value for the number of auto resets parameter is 4.

No Main PW (no main power)

Description

The no mains power delay parameter sets the period of time that the starter must have a run command without mains power before a no mains fault will occur. If line power is not applied, the starter will display No Line in the bottom left of the LCD.

Fault Code 98 - No Mains Power will be displayed when a start is commanded and the delay is exceeded.

Values

The no mains power delay parameter is adjustable from 1 to 5 seconds in 1 second intervals

Default

The default value for the no mains power parameter is 1 second.

5.23 MOTOR PROTECTION - FAULT CLASSES

Fault Classes

Description

The fault classes menu allows the user to change the action taken when a fault occurs. The menu will allow every fault to be given a different classification depending on the user requirements. This allows the user to set the starter to;

- Trip the starter and display the fault code and description if it occurs.
- Ignore the fault if it occurs and continue to run.
- Activate a relay if the fault occurs and continue to run.

⌘ **NOTE:** Not all faults can be assigned every classification. Faults critical to starter operation may only be programmed to non-critical (NonC) and/or critical (Crit).

Values

Each fault can be classified as;

- NonC - Non-critical fault. Starter will trip. Resets if JPC19 set to 1-2.
- Crit - Critical fault. Starter will trip and require a manual reset.
- Dis - Fault is disabled. No action will be taken when fault occurs.
- WrnA - Fault will not trip starter. Energizes relay programmed to WrnA.
- WrnB - Fault will not trip starter. Energizes relay programmed to WrnB.
- WrnC - Fault will not trip starter. Energizes relay programmed to WrnC.

⌘ **NOTE:** Each relay output can be assigned to as many different faults as required.

Default

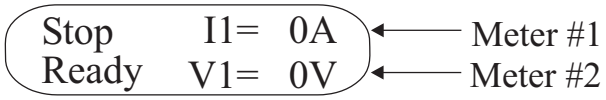
The default value for each fault depends on the fault.

⌘ **NOTE:** See Fault/Log Codes in Troubleshooting Section.

Meter #1 , Meter #2

Description

The RediStart Micro II displays two meter functions on the right side of the display. These parameters set what each meter will display. The meter locations are as shown.



Values

The meter#1 display and meter#2 display parameters can each be set to one of the following;

- Asc - Each phase current in a scrolling manner.
- Aav - Average current.
- A1 - Phase 1 current.
- A2 - Phase 2 current.
- A3 - Phase 3 current.
- Vsc - Each phase voltage in a scrolling manner.
- Vav - Average voltage.
- V1 - Phase 1 voltage.
- V2 - Phase 2 voltage.
- V3 - Phase 3 voltage.
- Hz - Line Frequency.
- O/L - Thermal overload in percentage from 0% to 100% (100% = Trip).
- pf - Motor power factor.
- etm - The elapsed running time in tenths of an hour.
- Hetm - The elapsed running time in hours.
- Uetm - The user resettable elapsed running time.
- Ustr - The user resettable motor starts counter.
- KW - Motor real power consumption.
- KWH - Kilo-watt-hours used by the motor.
- MWH - Mega-watt-hours used by the motor.
- KVar - Motor reactive power consumption.
- KVA - Motor apparent power consumption.
- Tv - Tachometer voltage.
- %s - Maximum speed in percentage.
- Ms - Motor speed.
- GDF - Ground fault current in amps.
- Srts - Motor starts counter.
- Ibal - Motor current imbalance in percentage.
- KW% - Calculated kilo-watt valve in % of Micro II torque units.
- TT% - Calculated TruTorque torque value in % of Micro II torque units.
- ComR - The number of communication requests received.
- ComT - The number of communication transmits sent.
- CRat - The communications rate.
- RTD#? - The temperature being read by RTD with the number ?.
- TAmx - The maximum temperature being read by a RTD.
- TSmx - The maximum temperature being read by a stator RTD.
- TBmx - The maximum temperature being read by a bearing RTD.
- TApk - The peak temperature being read by a RTD.
- TSpk - The peak temperature being read by a stator RTD.
- TBpk - The peak temperature being read by a bearing RTD.
- IAmx - The number of the RTD reading the highest temperature.
- ISmx - The number of the RTD reading the stator highest temperature.
- IBmx - The number of the RTD reading the highest bearing temperature.
- IApk - The number of the RTD reading the peak temperature.
- ISpk - The number of the RTD reading the peak stator temperature.
- IBpk - The number of the RTD reading the peak bearing temperature.

Default

The default value for the meter #1 display parameter is Asc.
The default value for the meter #2 display parameter is Vsc.

⌘ **NOTE:** The following meters will show a single decimal place when below the AutoRange setpoint: etm, Hetm, Uetm, KW, KWH, MWH, KVar, KVA. The value will show MAX and stop incrementing when they reach (6553). All other meters will show MAX when they reach (9999).

AutoRange

Description The autorange parameter sets the value where the display meter will change ranges.

Values The autorange can be set from 50.0 to 99.9 in 0.1 intervals.

Default The default value for the autorange parameter is 99.9.

Meter Rsts (meter resets)

Description The meter resets parameter allows the user to reset the different RediStart Micro II meters.

Values The meter resets can be set to the following;

- None - No meter resets.
- KWH - Reset the kilo-watt hour meter.
- RunT - Reset the user run time hours meter.
- Strt - Reset the user number of starts counter.
- SCtr - Reset the serial communication counters.
- RTDP - Reset the peak RTD meters.

When set to any of these values, the parameter will automatically return to None but the meter will be reset.

Default The default value for the meter resets parameter is None.

Scroll Tim (scroll time)

Description The scroll time parameter sets the delay time between display pages. If this is set to a time, the display will switch between different pages which will show all the different metering values. See page 27 for a description of the display pages. If this is set to Off, the display pages can be viewed by pressing the Up or Down buttons.

Values The scroll time is adjustable from 1 second to 120 seconds in 1 second intervals. The meter scroll time can also be turned Off.

Default The default value for the scroll time is Off.

Relay#1, K5 and Relay#2, K6

Description

The relay #1, K5 and relay #2, K6 parameters set the functionality of the two programmable relays on the RediStart Micro II power card (see power card layout on page 129).

The shunt trip (SHT) contact option will change the relay state on various fault scenarios. If the automatic fault reset jumper is set to manual, this relay will change state on any fault. If the automatic fault reset jumper is set to automatic, this relay will change state on any critical fault or the number of auto resets parameter value has been reached (see page 75).

Values

The relay #1 output and relay #2 output can each be set to one of the following;

- OL - The thermal overload has tripped.
- OLL - The thermal overload is locking out starter operation.
- OLW - The thermal overload is above 90% content and about to trip.
- RUN - The starter is applying voltage to the motor.
- UTS - The motor is running at full speed.
- SCR - The starter has detected a shorted SCR.
- SHT - Provides a shunt trip output for tripping a circuit breaker.
- GDF - Changes state when a ground fault condition is detected.
- OCT - Changes state when an over-current condition is detected.
- UCT - Changes state when an under-current condition is detected.
- TL - Unit has sensed a tachometer loss.
- PORT - Starter is in Power Outage Ride Thru mode.
- RDY - All conditions ready to run.
- RM#1 - Remote MODBUS operated contact #1.
- RM#2 - Remote MODBUS operated contact #2.
- RM_R - Remote communications run contact.
- RTDw - A RTD is sensing a temp. over it’s programmed warning level.
- RTDa - A RTD is sensing a temp. over it’s programmed alarm level.
- RTDf - A RTD has failed either open or shorted.
- WrnA - Fault warning relay for faults set to a WrnA classification.
- WrnB - Fault warning relay for faults set to a WrnB classification.
- WrnC - Fault warning relay for faults set to a WrnC classification.

Default

The default value for the relay #1 output parameter is RUN.
The default value for the relay #2 output parameter is UTS.

Opt. #?, K?

Description

The optional #x or ?, K? (where ? represents the relays numbered 1 to 7) parameters set the functionality of the four or seven programmable relays on the optional relay cards.

If the optional four (BIPC 300013-01) relay card is used, only parameters #1 to #4 will each set the operation of one of the relays on the card (see the four relay card layout on page 130).

If the optional seven (BIPC 300029) relay card is used, then parameters #1 to #7 will each set the operation of one of the relays on the card (see the seven relay card layout on page 130).

Four Relay Card
- DPDT - Dual Form C
- 5A, 250VAC, resistive
- 2A, 250VAC, 0.4 PF
- 5A, 30VDC, resistive
- 500VA inrush

Seven Relay Card
- SPDT - Form C
- 8A, 250VAC, resistive
- 4A, 250VAC, 0.4 PF
- 8A, 30VDC resistive
- 800VA inrush

⌘ **NOTE:** If communications is enabled. Optional Relay #4 will be fixed as RM_R.

Values

The optional #x, Kx output can each be set to one of the following;

- OL - The thermal overload has tripped.
- OLL - The thermal overload is locking out starter operation.
- OLW - The thermal overload is above 90% content and about to trip.
- RUN - The starter is applying voltage to the motor.
- UTS - The motor is running at full speed.
- SCR - The starter has detected a shorted SCR.
- SHT - Provides a shunt trip output for tripping a circuit breaker.
- GDF - Changes state when a ground fault condition is detected.
- OCT - Changes state when an over-current condition is detected.
- UCT - Changes state when an under-current condition is detected.
- TL - Unit has sensed a tachometer loss.
- PORT - Starter is in Power Outage Ride Thru mode.
- RDY - All conditions ready to run.
- RM#1 - Remote MODBUS operated contact #1.
- RM#2 - Remote MODBUS operated contact #2.
- RM_R - Remote communications run contact.
- RTDw - A RTD is sensing a temp. over it's programmed warning level.
- RTDa - A RTD is sensing a temp. over it's programmed alarm level.
- RTDf - A RTD has failed either open or shorted.
- WrnA - Fault warning relay for faults set to a WrnA classification.
- WrnB - Fault warning relay for faults set to a WrnB classification.
- WrnC - Fault warning relay for faults set to a WrnC classification.

Default

The default values vary with the starter model and options supplied.

⌘ **NOTE:** Relay - K1 is fixed as up to speed (used for bypass contactor)
Relay - K2 is fixed as run (used for in-line contactor)

Event Recorder

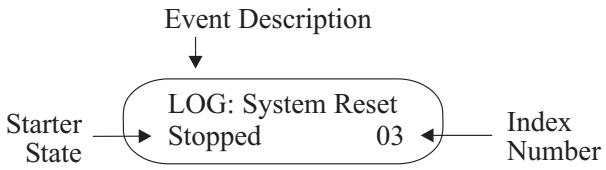
Description

The event recorder stores the last 99 events. An event is anything that changes the present state of the starter. Examples of events include an operation fault, a Start command, or a Stop command.

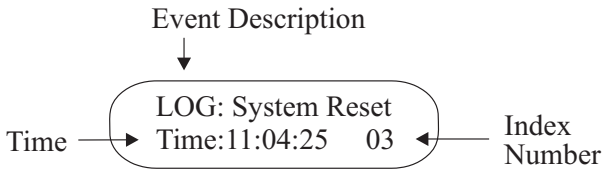
When the event recorder is entered, the last (newest) event is displayed. This is event number 00 as shown in the bottom right side of the display. To look at the events from the newest to oldest, press the Up button to advance from event 01 to 99.

Event Recorder Layout

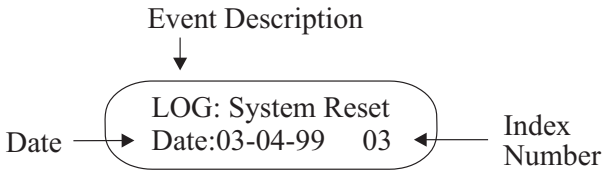
The first screen that is displayed in the event recorder gives the starter state on the second line of the display. See below;



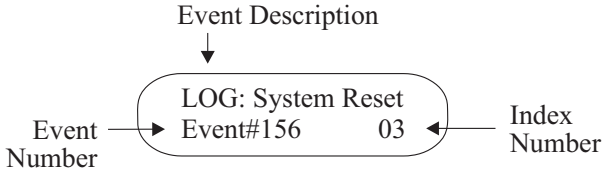
The time of the event can be displayed on the bottom line of the display by pressing the Enter button once. See below;



The date of the event can be displayed on the bottom line of the display by pressing the Enter button once again. See below;



The fault/Log number can be displayed on the bottom line of the display by pressing the Enter button once again. For more information on the fault, look up the fault number in the table on page 100. See below;



Press the Enter button again to return to the first display screen.

5.27 EVENT RECORDER

Event Description

The top line of the event recorder lists the event description. The two things that can be listed in the event recorder are a change in the state of the starter or a fault. A change in the state of the starter is listed in the event recorder with "Log:" before the description. A fault that occurred is just listed in the event recorder by its description.

Starter State

The starter state lists what state the starter was in when the event occurred. The possible states are listed below:

Message	Run Command	Ramp #2 Command (JC13-9)	Power to Motor	Motor At Full Speed
Faulted				
FWD1/RUN:RAMP	X		X	
FWD2/RUN:RAMP	X	X	X	
FWD1/RUN:UTS	X		X	X
FWD2/RUN:UTS	X	X	X	X
FWD1/RUN:DEC			X	
FWD2/RUN:DEC		X	X	
FWD1/RUN:STOP				
FWD2/RUN:STOP		X		

Time

The time gives the time of day that the event occurred. The format is hours:minutes:seconds.

Date

The date gives the day on which the event occurred. The format is month-day-year.

Fault/Log Number

The fault/log number can be used when referring to the event. This number, along with the fault description, will be shown on the display at the time the fault occurred and caused the starter to trip. The number can also be referred to in the fault table on page 100 for a more detailed description of the fault as well as some possible solutions.

System Clock

Description

The RediStart Micro II comes with a real time clock. The user can enter the actual time and the starter will use this time when it logs events in the event recorder. This can help with troubleshooting.

Restrictions

The RediStart Micro II clock can not be set if there is a starter lockout timer present or if the factory password has been entered.

Minutes

The minutes parameter should be set to the present minute.

Hours

The hours parameter should be set to the present hour using 24 hour convention.

Day

Enter the current day of the month.

Month

Enter the current month of the year.

Year

Enter the current year.

⌘ **NOTE:** The system clock does not recognize daylight savings time.

5.29 CONTROL CONFIG - SYSTEM PASSWORD

Password

Description

The system password protection will lock out the adjustment of all parameters except for the meter #1 display and meter #2 display.

The RediStart Micro II is shipped with the password feature disabled. This is confirmed by a password setting of Off. When the password has been set, a password of 500 appears under this parameter.

Setting the Password

To set a password, change the value of the password from Off to any user selected number between 001 and 999, excluding 500.

To make the password active, press the computer reset button, change the password to 500, or cycle the control power.

When the parameters are password protected, a dot will appear in the bottom middle of the main screen display only and the password will be 500 when the password menu is entered.

Removing the Password

To remove the password protection, change the value of the password from 500 to the user selected number. Once this is done, change the password to Off. This will remove the user selected password and disable the password protection. The password can not be set to off unless the correct password has been entered.

To change any parameter when a password is set, change the password from 500 to the user selected number. Once the parameter has been changed, press the computer reset button or change the password to any other value except for Off.

Values

The password can be set to any value between 001 and 999, excluding 500. The password can also be set to Off by setting it under 001.

Default

The default value for the password parameter is Off.

User Selected Password

_____

COMM. Mode (communications mode)

Description

The communications mode parameter sets the mode of serial communications.

The starter requires the addition of a serial communications card to be able to use serial communications. See the RS232/RS485 Communications Manual for details on serial communications.

The starter is capable of DeviceNet communications without any additional hardware. See the DeviceNet manual for details.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The communications mode can be set to the following values:

OFF - Serial communications is disabled.
M232 - Use RS-232 serial communications with MODBUS RTU protocol.
M485 - Use RS-485 serial communications with MODBUS RTU protocol.
A232 - Use RS-232 serial communications with Benshaw ASCII protocol.
A485 - Use RS-232 serial communications with Benshaw ASCII protocol.
DNet - Use DeviceNet communications.

Default

The default value for the communications mode parameter is OFF.

COM Addres (communications address)

Description

The communications address parameter sets the starter address when using RS-485 communications. The equipment that is communicating with the RediStart Micro II must use the same address as this to communicate with the starter.

Values

The communications address can be set from 0 to 255.

Default

The default value for the communications address is 127.

COM Delay (communications delay)

Description

The communications delay parameter sets the delay time between the starter receiving a communications request and it responding to the request. The communications delay may have to be increased to give the equipment that sent the communications request enough time to switch to receiving mode before the response is sent.

Values

The communications response delay can be set from 0.02 to 2.00 seconds in 0.01 second intervals.

Default

The default value for the communications response delay is 0.35 seconds.

MB:Baud (ModBUS baud rate)

Description

The MODBUS baud rate parameter sets the communications speed.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The ModBUS baud rate parameter can be set to;

- 2400 - 2400 bits per second.
- 4800 - 4800 bits per second.
- 9600 - 9600 bits per second.

Default

The default value for the MODBUS baud rate parameter is 2400 bits per second.

MB:Com T/O (ModBUS communications timeout)

General

The ModBUS communications timeout sets the time that the serial port controlled relays will stay energized without receiving a valid communications request. If a valid serial communications request is not received for the time that is set, the starter will de-energize the relays. The relays that are affected by this parameter are the RM#1, RM#2 and RM_R relays.

Values

The MODBUS communications timeout can be set from 1 to 900 seconds in 1 second intervals. If can also be set to Off by going below 1 second.

Default

The default value for the MODBUS communications timeout parameter is Off.

DN:MAC ID (DeviceNet MAC ID)

General

The DeviceNet MAC ID sets the address for the starter as a DeviceNet node.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The DeviceNet MAC ID can be set from 0 to 63.

Default

The default value for the DeviceNet MAC ID is 63.

DN:Baud (DeviceNet baud rate)

General

The DeviceNet baud rate sets the DeviceNet communications speed.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The DeviceNet baud rate parameter can be set to;

- 125 kbps
- 250 kbps
- 500 kbps

Default

The default value for the DeviceNet baud rate is 125 kbps.

DN:InAssy (DeviceNet input assembly)

General

The DeviceNet input assembly parameter sets the format for the input data. Refer to the DeviceNet manual for details.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The DeviceNet input assembly can be set to;

- 50
- 51
- 52
- 53
- 60
- 61

Default

The default value for the DeviceNet input assembly is 61.

DN:OutAssy (DeviceNet output assembly)

General

The DeviceNet output assembly parameter sets the format for the output data. Refer to the DeviceNet manual for details.

⌘ **NOTE:** The RediStart Micro II must be reset after this parameter is changed.

Values

The DeviceNet output assembly can be set to;

- 1
- 2
- 3
- 100

Default

The default value for the DeviceNet output assembly is 100.

DN:T/O Act (DeviceNet timeout action)

General

The DeviceNet timeout action parameter selects what the RediStart Micro II does in the event that the DeviceNet connection times out.

Values

The DeviceNet timeout action can be set to none or stop.

Default

The default value for the DeviceNet timeout action is none.

DN:Rev 5.2 (DeviceNet interface revision)

General

The DeviceNet interface revision reports the revision stored in the Identity Object (class1, attribute 4). The revision refers to the set of objects and attributes implemented in the RediStart Micro II. As new objects and attributes are implemented, the revision will increase. The revision may be used to ensure the correct version of the DeviceNet manual and EDS file are obtained.

Values

The revision is listed in the form Major, Minor.

5.31 CONTROL CONFIG - OPTIONS LIST

Options List

Description

The options list menu provides a list of the installed options on the starter. It can be used to determine what options have been added to the starter.

Values

The following is a list of the possible options;

- RSM MICRO II - RediStart Micro II reduced voltage software.
- Reversing - Starter has reversing capability.
- Braking - Starter has DC injection braking.
- HD Braking - Starter has heavy duty braking.
- Two Speed - Starter is for two speed motor.
- MV Series - Medium Voltage 2200 to 4800VAC.
- Tachometer - Starter has tach feedback for linear ramp.
- Jog/Heater - Starter has jog and motor heater.
- SYNC - Starter has synchronous motor control.
- SEP - Stand-alone synchronous field controller.
- PORT - Power-outage ride through.
- ID Motor - Inside-delta motor starter.
- Dyn. Brake - Synchronous motor braking using field DC.

⌘ **NOTE:** Some options are not available on some starter series. For example, reversing and braking are not available on a medium voltage starter. Contact Benshaw for details.

Software Part #

Description

The software part number sub-menu gives the part number of the software. This information is useful for future service reasons.

If calling Benshaw for service, this number should be recorded so it can be provided to the service technician.

Values

The following is a list of possible software part numbers. The xx represents the software revision number which changes as the software is updated.

- 810010-02-xx - MV standard soft-starter

⌘ **NOTE:** This manual has specific data pertaining to this software only. If a different software part number is displayed on the starter, contact Benshaw for the proper instruction manual.

C.T. Ratio (circuit transformer ratio)

Description

The CT ratio must be set to match the CT's (current transformers) supplied with the starter. This allows the starter to properly calculate the current supplied to the motor.

Values

The CT ratio can be set to following values:

- 100 (:1 or 20:0.2)
- 288 (:1 or 58:0.2)
- 720 (:1 or 144:0.2)
- 864 (:1 or 173:0.2))
- 1000 (:1 or 200:0.2))
- 2640 (:1 or 528:0.2)
- 2880 (:1 or 576:0.2)
- 3900 (:1 or 780:0.2))
- 5000 (:1 or 1000:0.2)
- 5760 (:1 or 1152:0.2)

Default

The default value for the CT ratio is 288 (:1).

Relay Card

Description

The relay card parameter should be set to reflect the optionally installed relay card.

Values

The relay card can be set to;

- None - no relay card installed
- OUT4 - four relay output card installed
- OUT7 - seven relay output card installed

Default

The default value for the relay card parameter is Out 4.

Start BIST (starter built-in self test)

Description The Start BIST parameter sets the starter to perform the Built In Self Test when programmed to "Yes" and the Run/Test switch is in the test position. When programmed to "No" and the switch is in the test position, the operator can program or review the parameters without line voltage present.

Values The Start BIST parameter can be set to Yes or No.

Default The default value for the Start BIST parameter is No.

Test Inlin (test in-line)

Description The test in-line parameter sets the starter to test the in-line contactor. If the in-line contactor can not be tested by the BIST test (see page 114), then this parameter should be set to no.

Values The test in-line parameter can be set to Yes or No.

Default The default value for the test in-line parameter is Yes.

Test Bypas (test bypass)

Description The test bypass parameter sets the starter to test the bypass contactor. If the bypass contactor can not be tested by the BIST test (see page 114), then this parameter should be set to no.

Values The test bypass parameter can be set to Yes or No.

Default The default value for the test bypass parameter is Yes.

100% Gates

Description The 100% gates parameter sets the SCR gate firing pattern when a BIST test is performed (see page 114). If this parameter is set to Yes, the SCR gates will all be fired continuously. If this parameter is set to No, the SCR gates will be fired in a sequential pattern.

Values The 100% gates parameter can be set to Yes or No.

Default The default value for the 100% gates parameter is No.

5.35 FACTORY SETUP - FACTORY CONTROL

FACT Pass. (factory password)

Description The factory password parameter must be set to the proper password to allow access to the rest of this menu. The password is different for each day of the year. If it is required, Benshaw will supply the password for this menu for the day it is needed.

⌘ **NOTE**: Entering a password will lock the System Clock to the set values, and it is not possible to enter the password twice in the same day.

Values The factory password is adjustable from 0 to 9999.

Default The default value for the factory password parameter is 0.

Reset Def (reset to default parameters)

Description When the Reset Def parameter is set to Yes, all parameters are reset to their default values.

Values The Reset Def parameter can be set to No or Yes.

Default The default value for the Reset Def parameter is No.

CLR Events (clear event log)

Description When the CLR Events parameter is set to Yes, the event log is cleared of its events.

Values The CLR Events parameter can be set to No or Yes.

Default The default value for the CLR Events parameter is No.

CLR Pass. (clear password)

Description If a System Password has been set through the Control Config. menu, setting the CLR Pass. parameter to Yes will clear this password.

Values The CLR Pass. parameter can be set to No or Yes.

Default The default value for the CLR Pass. parameter is No.

Harm Calib (voltage drop compensation)

Description This parameter adjusts the voltage compensation factor to correct the Micro II's voltage reading to compensate for voltage harmonics and large voltage drops that occur with high impedance sources during starting. It operates by measuring the line voltage before the start command is given and then during the motor start calculating the line drop based on difference between the measured voltage before the start and the raw measured line voltage during the start. The corrected line voltage, adjusted based on the calculated compensation factor, is displayed and used for all Micro II calculations such as the Over/Under Voltage Fault.

Example: If the "Harm Calib" parameter is set to 0.20% then for every 1% in measured voltage drop the MicroII's voltage reading will be increased by 0.2%. Another way of looking at this is for every 10% in measured line drop the Micro II's voltage reading will be boosted by 2%. (i.e. the voltage displayed will only show an 8% drop).

⌘ **NOTE:** This compensation factor is not active when UTS (SCRs full on or bypass contactor in) or when used with ATL starters.

Values 0.00% (no compensation) to 0.50% (+0.5% per every 1% in measured drop).

Default The default value is 0.20% (add 0.20% to the voltage reading for every 1% in measured line drop).

Cal Volt L1, L2, L3 (calibrate voltage meter)

Description If greater accuracy is desired for line voltage measurements, the Cal Volt L1, L2, L3 parameters can be used for calibration.

⌘ **NOTE**: A calibrated voltage source or independent calibrated voltage meter is required.

Values The Cal Volt L1, L2, or L3 parameters are adjustable from a ratio of 900 to 1100 representing 90.0% to 110.0% in 0.1% increments.

Default The default value for the Cal Volt L1, L2, or L3 parameter is 1000.

Cal Curr L1, L2, L3 (calibrate current meter)

Description If greater accuracy is desired for line current measurements, the Cal Curr L1, L2, L3 parameters can be used for calibration.

⌘ **NOTE**: A calibrated current source or independent calibrated current meter is required.

Values The Cal Curr L1, L2, or L3 parameters are adjustable from a ratio of 900 to 1100 representing 90.0% to 110.0% in 0.1% increments.

Default The default value for the Cal Curr L1, L2, or L3 parameter is 1000.

UTS Detect (current level for up-to-speed determination)

Description This parameter adjusts the current level need for up-to-speed (UTS) determination. During starting after the motor current drops below this level then UTS can be declared. (Note: Motor current dropping below this limit is just one of many factors used to determine if a motor has achieved full speed). Adjustment of this level is usually only performed due to motor with unusual starting characteristics or applications such as centrifuges where the motor current may remain above 175% for an extended amount of time during starting.

Range 100% FLA to 500% FLA in 1% steps.

Default The default value is 175% FLA.

Mod#1 Addr (module #1 address)

Description The module #1 address parameter has to be set to the MODBUS address of the first RTD module attached to the soft-starter. The address of the RTD module can be verified by checking the rotary switch on the top of the RTD module.

Values The RTD module #1 address can be set from 16 to 23 in increments of 1.

Default The default value for the RTD module #1 address is 16.

Mod#2 Addr (module #2 address)

Description The module #2 address parameter has to be set to the MODBUS address of the second RTD module attached to the soft-starter. The address of the RTD module can be verified by checking the rotary switch on the top of the RTD module. Ensure that module #2 is not set to the same address as module #1.

Values The RTD module #2 address can be set from 16 to 23 in increments of 1.

Default The default value for the RTD module #2 address is 17.

#RTDs Mod1 (number of RTDs on module #1)

Description The number of RTDs on module 1 parameter sets the number of RTD inputs that are being used on first RTD module. If this parameter is set to None, then the RediStart Micro II will not attempt to communicate with module #1.

Values The # of RTD's on module 1 parameter can be set from 1 to 8. The parameter can also be set to None by going below 1.

⌘ **NOTE:** Must be number of the highest RTD being used (Ex. If 1-8 are being used and not 2-7 you must program 8 RTDs.)

Default The default value for the # or RTD's on module 1 parameter is None.

#RTDs Mod2 (number of RTDs on module #2)

Description The number of RTDs on module 2 parameter sets the number of RTD inputs that are being used on second RTD module. If this parameter is set to None, then the RediStart Micro II will not attempt to communicate with module #2.

Values The # of RTD's on module 2 parameter can be set from 1 to 8. The parameter can also be set to None by going below 1.

⌘ **NOTE:** Must be number of the highest RTD being used (Ex. If 1-8 are being used and not 2-7 you must program 8 RTDs.)

Default The default value for the # or RTD's on module 2 parameter is None.

Temp Scal (temperature scale)

Description The temperature scale parameter sets the units used for temperature measurements.

Values The temperature scale can be set to;

- C - All RTD temperature values and set points are in degrees Celsius.
- F - All RTD temperature values and set points are in degrees Fahrenheit.

Default The default value for the temperature scale is C (degrees Celsius).

RTD#? Grp (RTD #? Group)

Description

The RTD #? group (where ? is the RTD number) parameter allows the user to assign the RTD to a specific group. The values from the RTD's that are assigned to a group are used to provide the meters for that group.

Values

The RTD #? group parameter can be set to;

- None - The RTD operates independently.
- Stator - The RTD operates as part of the stator metering group.
- Bearing - The RTD operates as part of the bearing metering group.

Default

The default value for the RTD #? Group parameter is None.

RTD#? Warn (RTD #? warning level)

Description

The RTD #? warning (where ? is the RTD number) parameter sets the temperature that a warning will occur for that RTD.

Values

The RTD #? warning parameter is adjustable from 0 to 200°C or 32 to 392°F in 1° increments. If the parameter is set one step below the lowest temperature, the parameter can be set to Off.

Default

The default value for the RTD #? warning parameter is Off.

RTD#? Alm (RTD #? alarm level)

Description

The RTD #? alarm (where ? is the RTD number) parameter sets the temperature that a trip will occur for that RTD.

Values

The RTD #? alarm parameter is adjustable from 0 to 200°C or 32 to 392°F in 1° increments. The parameter can also be set to Off by going one step below the lowest temperature.

Default

The default value for the RTD #? alarm parameter is Off.

RTD#? Grp (RTD #? Group)

Description

The RTD #? group (where ? is the RTD number) parameter allows the user to assign the RTD to a specific group. The values from the RTD's that are assigned to a group are used to provide the meters for that group.

Values

The RTD #? group parameter can be set to;

- None - The RTD operates independently.
- Stator - The RTD operates as part of the stator metering group.
- Bearing - The RTD operates as part of the bearing metering group.

Default

The default value for the RTD #? Group parameter is None.

RTD#? Warn (RTD #? warning level)

Description

The RTD #? warning (where ? is the RTD number) parameter sets the temperature that a warning will occur for that RTD.

Values

The RTD #? warning parameter is adjustable from 0 to 200°C or 32 to 392°F in 1° increments. If the parameter is set one step below the lowest temperature, the parameter can be set to Off.

Default

The default value for the RTD #? warning parameter is Off.

RTD#? Alm (RTD #? alarm level)

Description

The RTD #? alarm (where ? is the RTD number) parameter sets the temperature that a trip will occur for that RTD.

Values

The RTD #? alarm parameter is adjustable from 0 to 200°C or 32 to 392°F in 1° increments. The parameter can also be set to Off by going one step below the lowest temperature.

Default

The default value for the RTD #? alarm parameter is Off.

6. TROUBLESHOOTING

LED Diagnostics

General

There are several LEDs located on the RediStart Micro II circuit cards. These LEDs can be used to help troubleshoot problems with the starter. Refer to the circuit card layouts for LED locations.

CARD	LED #	NAME	INDICATION
Computer BIPC-300040-X-X	LEDC1 (Red)	Watch Dog/Power Fail/ Reset	On when reset/CPU failure/control voltage failure.
	LEDC2 (Red)	Control power	On if control voltage is present.
	NS (Red)	DeviceNet Network Status	See DeviceNet manual.
	MS (Red)	DeviceNet Module Status	See DeviceNet manual.
Power Card BIPC-300030-X-X	No LEDs		
Fibre Optic Transmitter Card BIPC-30004-X-X	LED1 (Red)	Power	On if control voltage is present.
	LED2 (Green)	OK Status	On if Gate cards are OK.
Gate Driver Card BIPC-300047-X-X	D2 (Green)	Power	On if control voltage is present.
	D9 (Green)	OK Status	On if card is OK.
	D39 (Green)	Gate Firing	On when SCR is being fired.
	D40 (Green)	Gate Firing	On when SCR is being fired.
	D43 (Green)	Gate Firing	On when SCR is being fired.
	D44 (Green)	Gate Firing	On when SCR is being fired.
	D47 (Green)	Gate Firing	On when SCR is being fired.
	D48 (Green)	Gate Firing	On when SCR is being fired.
OPTIONAL CARDS			
Local I/O Controller Card BIPC-300017-X-X	DE (Yellow)	Data Enable	On when card is transmitting data.
	TXD (Red)	Transmit Data	On when card is transmitting data.
	RXD (Green)	Receive Data	On when card is receiving data.
	LED1/D3 (Red)	Operation	Flashes when card is operating.
	LED2/D2 (Red)	Communication	On when valid data is received over the master link.
Remote RTD Module SPR-100P	TX (Red)	Transmit Data	On when card is transmitting data.
	RX (Green)	Receive Data	On when card is receiving data.
	Status (Green)	Operation	On when module measures RTD.

Meter Tests

Resistance

The SCR's in the starter can be checked with a standard ohmmeter to determine their condition.

Remove power from the starter before performing these checks.

Check from L to T on each phase. The resistance should be typically over 50K ohms.

Check between the gate leads for each SCR (red and white twisted pairs). The resistance should be from 8 to 50 ohms.

⌘ **NOTE:** The resistance measurements may not be within these values and the SCR may still be good. The checks are to determine if an SCR is shorted L to T or if the gate on an SCR is shorted or open. An SCR could also still be damaged even though the measurements are within the above specifications.

Event Recorder

General

The RediStart Micro II has an event recorder which stores the event description, motor state, time, and date of the last 100 events that have occurred. An event is anything that changes the present state of the starter. Examples of events can include a start, a stop, an overload warning, or a fault. See page 81 for a complete description of the event recorder.

Performing an Emergency Restart

General

The RediStart Micro II has an emergency restart feature which allows the user to override any lock-outs that are present. This feature should only be used in an emergency. Before an emergency reset is performed, the reason for the lock-out and the condition of the motor should be examined to ensure that the motor is capable of being re-started without causing any damage.

Performing a Reset

Place a jumper between pins 6 and 11 of JC11 on the computer card. Hold the Enter button on the display and press the thermal overload reset pushbutton until a microprocessor reset occurs.

⌘ **NOTE:** Control power on the cards must be present.

Fault/Log Codes

General

The following is a list of the possible fault and log codes that can be generated depending on the type of starter.

The fault class lists the default setting for each fault.

⌘ **NOTE**: Refer to page 82 for a list of the possible states the starter can be in when a fault/event occurs.

Fault Analysis

When a fault occurs, the LCD display will identify the fault. Be sure to clear all faults before attempting to restart the unit.

⌘ **NOTE**: If the fault persists and all corrective programming has been attempted, contact a Benshaw service technician for further assistance.

Fault/Log Number	Fault Class	Fault/Event Recorder Text	Description/Possible Solutions
1	NonC	Sequence Not CBA	• Incoming phase sequence is actually ABC but starter is set to CBA (see page 75).
2	NonC	Sequence Not ABC	• Incoming phase sequence is actually CBA but starter is set to ABC (see page 75).
3	NonC	No Phase Order	• No phase order detected.
4	NonC	High Freq. Trip	• Line frequency went above the high freq. trip setting (see page 67). • Line power quality problem. • Low control power problem. • Generator governor is malfunctioning.
5	NonC	Low Freq. Trip	• Line frequency went below the low freq. trip setting (see page 67). • Line power quality problem. • Low control power problem. • Generator governor malfunctioning.
15	Crit	Phase Order Err	• Phase order error.
16	Crit	Bad OP Code Err	• Bad op-code error.
17	NonC	Over voltage L1	• The voltage on line 1 went above the high/low voltage setting (see page 66).
18	NonC	Over voltage L2	• The voltage on line 2 went above the high/low voltage setting (see page 66).
19	NonC	Over voltage L3	• The voltage on line 3 went above the high/low voltage setting (see page 66).
20	NonC	Low Line#1	• The voltage on line 1 went below the high/low voltage setting (see page 66).
21	NonC	Low Line#2	• The voltage on line 2 went below the high/low voltage setting (see page 66).
22	NonC	Low Line#3	• The voltage on line 3 went below the high/low voltage setting (see page 66).
23	NonC	Curr. Imbal. HL1	• The current on line 1 went above the current imbalance setting (see page 64).
24	NonC	Curr. Imbal. HL2	• The current on line 2 went above the current imbalance setting (see page 64).
25	NonC	Curr. Imbal. HL3	• The current on line 3 went above the current imbalance setting (see page 64).
26	NonC	Curr. Imbal. LL1	• The current on line 1 went below the current imbalance setting (see page 64).
27	NonC	Curr. Imbal. LL2	• The current on line 2 went below the current imbalance setting (see page 64).
28	NonC	Curr. Imbal. LL3	• The current on line 3 went below the current imbalance setting (see page 64).
29	Crit	Bad RAM Battery	• Bad RAM battery. • Replace IC16 or computer card to correct problem. • To clear fault, hold the down arrow key and perform a computer reset. Continue holding the down arrow key until fault 30 appears on the display.
30	Crit	Def Param Loaded	• The factory defaults for the parameters have been loaded. • Reset the computer to clear the fault. • All parameters have to be re-programmed as necessary.

Fault/Log Number	Fault Class	Fault/Event Recorder Text	Description/Possible Solutions
46	NonC	BIST Canceled	• The Built-In Self Test was canceled. • The disconnect was closed. • Line power was applied to the starter.
49	NonC	Tach Loss	• There was no tachometer feedback signal detected when a start was commanded.
50	Crit	Key Pad Failure	• The door mounted keypad has failed. • The Stop or Start button was held down while a computer reset was performed or while power was applied to the unit.
51	Crit	TT/KW Overcurrent Limit	• During TruTorque ramping or power control ramping, the motor current exceeded the TruTorque/KW Overcurrent Trip level (see page 62).
52	Crit	Curr. At Stop	• Current flow above the no current at run setting (see page 65) was detected while the starter was stopped. • Examine starter for shorted SCRs.
53	NonC	No Curr. At Run	• The motor current went below the no current at run setting (see page 65) while the starter was running. • The load was disconnected while running. • The motor is being driven by the load. • Check dip switches (SW1 and SW2) are in the correct position and orientation for the applicable CT ratio and motor full load current (FLA) rating.
56	NonC	Phase Detection	• Fault occurs when there is a loss of one or more phase voltages or there is a very large imbalance between the measured phase voltages. In these cases it has been detected that the starter can not remain reliably synchronized to the incoming line therefore a fault condition is entered. • Verify that all the phases of the incoming line are present and of the correct voltage. • Check source for blown fuses, open circuit breakers, or defective wiring. • On Medium voltage systems, verify the wiring of the voltage measurement circuit.
64*	Dis	Bad RTD Detected	• A bad RTD was detected (open or shorted lead).
65*	NonC	RTD Alarm Limit	• An RTD alarm set point was exceeded.
66*	NonC	RTD Comm Loss	• Communications with the RTD module was lost. • Check RS-485 wiring between the RTD module and card. • Check 24VDC RTD module power supply.
68	NonC	Jog Timer Limit	• The jog timer expired. • Examine reason for extended jog operation.
69	NonC	Zero Speed Timer	• The zero speed timer (see page 73) expired. • Check motor for jammed or overloaded condition.
70	NonC	Low Control PWR	• Control power is too low. • Examine control power transformer input and output voltages. • Check wiring between control power source and starter.
71	NonC	Ground Fault	• A ground fault current above the ground fault setting was detected. Refer to page 68 for the ground fault settings. • Megger motor and cabling (disconnected from starter).
72	Crit	DIP SW set Wrong	• CT burden DIP switch set incorrectly. • Set switches correctly (see page 22).
73	NonC	Bypass Fault	• The bypass contactor failed to stay energized. • Check separate bypass for proper wiring.
74	NonC	UTS Timer Limit	• The motor was not at full speed before the UTS time (see page 73) expired. • Check motor for jammed or overloaded condition.
75	NonC	External Trip	• Power was removed from the external trip input on the computer card (JC13-1). • Trip input delay is set too short(see page 74).
*Present only when an RTD module is in use.			

Fault/Log Number	Fault Class	Fault/Event Recorder Text	Description/Possible Solutions
76	Crit	Disconnect Open	• A start was commanded while the disconnect was open.
77	NonC	In-line Fault	• The in-line contactor did not close. • Check wiring to coil of contactor. • Check feedback wiring from auxiliary contactor to JC13-4 terminal. • Check in-line fault delay (see page 74).
78	NonC	Over Curr Trip	• The current went above the over-current trip setting (see page 70).
79	NonC	Under Curr Trip	• The current went below the under-current trip setting (see page 71).
90	Crit	OL Lock	• Used to set the operation of the overload.
91	Crit	Unauthorized RUN	• The start/stop circuitry has failed. • A fast start/stop sequence was performed. • Check wire connected to terminal JC13-3.
92	Crit	Shorted SCR	• A shorted SCR on line 1 was detected (Refer to page 69). • Check all phases for shorts in SCRs (Refer to page 99).
93	Crit	Shorted SCR	• A shorted SCR on line 2 was detected (Refer to page 69). • Check all phases for shorts in SCRs (Refer to page 99).
94	Crit	Shorted SCR	• A shorted SCR on line 3 was detected (Refer to page 69). • Check all phases with ohmmeter for shorts in SCRs.
95	Crit	Shorted SCR	• Shorted SCRs on line 2 and 3 were detected (Refer to page 69). • Check all phases with ohmmeter for shorts in SCRs.
96	Crit	Shorted SCR	• Shorted SCRs on line 1 and 3 were detected (Refer to page 69). • Check all phases with ohmmeter for shorts in SCRs.
97	Crit	Shorted SCR	• Shorted SCRs on line 1 and 2 were detected (Refer to page 69). • Check all phases with ohmmeter for shorts in SCRs.
98	NonC	No Mains Power	• A start was commanded while no line power was detected.
99	Crit	I. O. C.	• A very high current was detected. • Check the motor and wiring for short circuits.
101		Blank Log	• Blank Log.
102		Log:Disconnect O	• Log:Disconnect open.
103		Log:DIR Change	• The direction of the starter was changed.
104		Start Commanded	• A start command was given.
105		Stop Commanded	• A stop command was given.
106		Stop Complete	• The stop sequence is complete and the starter has removed power from the motor.
107		Log: System UTS	• Log: System UTS (up to speed).
147		Log:BIST Entered	• Log:BIST entered.
148		Log:BIST Passed	• Log:BIST passed.
154		Log:Password CLR	• Log:Password cleared.
155		Log:Events CLR	• Log:Event log cleared.
156		Log:System Reset	• Log:System Reset.
157		Log:Hardware PWR UP	• Log:Hardware PWR UP.
158		Log:Emerg Reset	• Log:Emergency reset.
159		Log:Time Changed	• Log:Time changed.
160		PWR Ret BYP IN	• Line power returned while the bypass contactor was in.

Fault/Log Number	Fault Class	Fault/Event Recorder Text	Description/Possible Solutions
161		PWR Ret BYP OUT	• Line power returned after the bypass contactor was dropped out.
162		PWR Loss Voltage	• PORT mode was entered due to low line voltage.
163		PWR Loss Current	• PORT mode was entered due to loss of current.
164		PORT BYP Open	• Bypass contactor was dropped out while in PORT mode.
165		Log:System Reset	• The unit was reset.
169		RTD Warn Limit	• One of the RTD warning set points was exceeded.
186		Log:If Ctrl Mode	• Log:If Ctrl Mode.
189		Log:OL Warn	• The thermal overload went above 90% thermal content.
190		Log:OL Lock	• The thermal overload tripped. • Check motor and load for cause of overload.

6.1 TROUBLESHOOTING

General Troubleshooting Charts

General

The following troubleshooting charts can be used to help solve some of the more common problems that occur.

Motor will not start, no output to motor.

Display	Cause	Solution
Fault Displayed.	• Shown on display.	• See fault code table.
Watchdog LED on.	• CPU card problem.	• Control voltage is low - check control voltage. • Consult factory.
Display is blank.	• Control voltage is absent. • FU1 on power card. • Ribbon Cables.	• Check for proper control voltage. • Replace FU1. • Check ribbon cables.
Stopped	• Control Devices • Display buttons disabled.	• Check control devices. • Enable display buttons.
No line	• Missing at least one phase of main power.	• Check power system.

Motor rotates but does not reach full speed.

Display	Cause	Solution
Fault displayed.	• Shown on display.	• See fault code table.
Accel or Running.	• Mechanical problems. • Inadequate current limit setting. • Improper parameter settings. • Abnormally low line voltage.	• Check for load binding. Check motor. • Increase maximum current setting. • Check parameter settings. • Fix line voltage problem.

Deceleration profile not operating correctly.

Problem	Cause	Solution
Motor stops too quickly.	• Time setting. • Improper level setting.	• Increase the decel time. • Increase decel level 1 and/or decel level 2.
Time seems correct but motor surges at start of decel.	• Decel level 1.	• Decrease decel level 1 in 5% steps until surge is eliminated.
Time seems correct but motor stops before cycle complete.	• Decel level 2. • TruTorque DCL End Torque.	• Increase decel level 2 in 5% steps until motor stops when decel cycle is complete. • Increase TruTorque DCL End Torque in 5% steps until motor stops when decel cycle is complete.
Time seems correct but water hammer occurs at end of cycle.	• Decel level 2. • TruTorque DCL End Torque.	• Decrease decel level 2 in 5% steps until water hammer is eliminated. • Decrease TruTorque DCL End Torque in 5% steps until water hammer is eliminated.

Motor stops while running.

Display	Cause	Solution
Fault displayed.	• Shown on display.	See fault code table.
Display is blank.	• Control voltage is absent. • FU1 on power card.	• Check control wiring and voltage. • Replace fuse.
Stopped	• Control devices.	• Check control system.

Other situations.

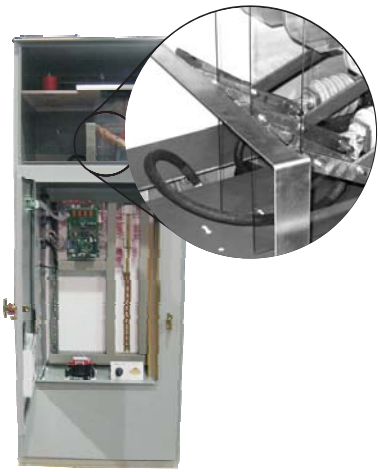
Problem	Cause	Solution
Power Metering not working.	• CT installed wrong.	• Fix CT installation. White dot to line side.
TruTorque/KW Ramp not working.	• CT installed wrong.	• Fix CT installation. White dot to line side.
Motor current or voltage fluctuates with steady load.	• Motor. • Power connection. • SCR fault.	• Verify motor is operating correctly. • Shut off all power and check connections. • Perform a BIST.
Erratic operation.	• Loose connections.	• Shut off all power and check connections.
Accelerates too quickly.	• Ramp time. • Initial current. • Maximum current setting. • Kick Start. • Improper FLA setting. • Initial torque. • Maximum torque.	• Increase ramp time. • Decrease initial current setting. • Decrease maximum current setting. • Lower Kick Start current or time. • Check FLA setting. • Decrease initial torque setting. • Decrease maximum torque setting.
Accelerates too slowly.	• Ramp time. • Initial current. • Maximum current setting. • Kick Start. • Improper FLA setting. • Initial torque. • Maximum torque.	• Decrease ramp time. • Increase initial current setting. • Increase maximum current setting. • Increase Kick Start current or time. • Check FLA setting. • Increase initial torque setting. • Increase maximum torque setting.
Motor overheats.	• Duty cycle. • High ambient. • Too long acceleration time. • Wrong overload setting. • Too long jog cycle.	• Allow for motor cooling between starts. • Provide better ventilation. • Reduce motor load. • Select correct overload setting. • Jog operation reduces motor cooling and increases current. Shorten jog cycle.
Motor short circuit.	• Wiring fault. • Power factor correction capacitors (PFCC) on starter output.	• Identify fault and correct. • Move PFCC to line side of starter.
Fans do not operate.	• Wiring. • Fuse. • Fan failed.	• Check wiring and correct. • Replace fuse. • Replace fan.
Display buttons don't work.	• Display ribbon cable. • Display faulty.	• Check faceplate cable on back of display. • Replace display.

Spare Parts

Part Number	Description	Used On	Quantity
BIPC-300040-05	CPU card 240VAC control	All	1
BIPC-300040-08	CPU card with DeviceNet	All	1
BIPC-300030-04	Power card standard for pulse system	2300 to 4160VAC	1
BIPC-300030-06	Power card tachometer for pulse system	2300 to 4160VAC	1
BIPC-300030-14	MV Power card standard for fiber system	2300 to 4160VAC	1
BIPC-300030-17	EMV Power card tachometer for fiber system	2300 to 4160VAC	1
BIPCLCD	Display assembly	All	1
BIPC-300013-01	4-Relay output card	Optional - All	1
BIPC-300029-01	7-Relay output card	Optional - All	1
BIPC-300000-04	RS-232 card	Optional - All	1
BIPC-300000-03	RS-485 card	Optional - All	1
BIPC-300042-02	RS-232/485 card	Optional - All	1
BIPC-300017-01	Local I/O Controller card (for RTD)	Optional - All	1
SPR-100P	Remote RTD Module 100Ω Platinum	Optional - All	1
BI-M-FU1	0.63A micro power card fuse	All	1
BIPCDVDT-3MV	DV/DT card		
BIPCDVDT-4MV	DV/DT card		
CT-100000-01	864:1 current transformer (172.8:0.2A)	0 amp to 200 amp units	3
CT-100000-00	2640:1 current transformer (528:0.2A)	201 amp to 400 amp units	3
CT-100000-02	5760:1 current transformer (1152:0.2A)	> 400 amp units	3
BIPC-300004-04	Fiber optic transmitter card	All	1
BIPC-300047-01	Fiber optic driver card	All	1

Minimum Safety Practices

Figure 1



Before performing any tests on electrical equipment make certain all PPE (Personal Protective Equipment) is worn. Check with your Health and Safety co-ordinator or for more information see (www.NFPA.ORG) Electrical Safety in the workplace.

Open the disconnect switch and perform lockout and tag procedures. After opening the switch and before opening door, use the viewing window to ensure that all three Load Break Interrupter Switch blades are open and resting on the ground bar. Use a flashlight if necessary (see picture).

There are several interlocks on the switches. They are for personal and/or equipment protection. Under no circumstances should they be made inoperative when the switch is in service. To do so could cause bodily injury, death and/or property damage.

Prior to commencing any testing procedures, ensure that the designated five minute wait period has passed, then discharge any power factor correction capacitors if present. The wait time allows the charge in the capacitors to dissipate.

Inspect the LV section first, using a voltage sniffer to verify that all voltage has been successfully removed or discharged.

Next, conduct the same tests within the MV section.

A smell test is then needed to detect a scent of burning or any visual trace of burn damage to the system.

Follow all grounding procedures set forth by the health and safety co-ordinator. If no such procedures are available contact NFPA 70E for the proper procedure.

Never energize a switch without the arc chutes and barriers installed in place.

For more details refer to Powercon PIF or MicroRupter Load Break Interrupter Switch Instruction Book with the switch model number supplied with the starter.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel familiar with medium voltage equipment are to perform work described in this set of instructions.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Turn off all power before working on or inside equipment.
- Use a properly rated voltage sensing device to confirm that the power is off.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power. Assume that circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Ohm Meter Testing

A few reasons for an SCR Test Procedure would be if the starter is receiving shorted SCR trips, current imbalance trips, or ground fault trips - basically the SCR is not turning on properly. If any cards have been replaced, it is also recommended to do a BIST test (see BIST testing).

Fuse Tests

A calibrated ohmmeter will be needed to perform the following tests. For accurate results, it is important to use the same ohmmeter throughout the tests and for each SCR in the starter. If all ohm readings are within specified limits, then the SCRs can be considered good and this procedure completed.

Perform ohmmeter resistance across both power and control fuses. Verify fuses for continuity.

Shorted SCR Tests

This will test the anode to cathode integrity of the SCR. Use the following table and figure to place the ohmmeter probes. You should not need to remove components to perform ohmmeter test.

Ohmmeter

Figure 2

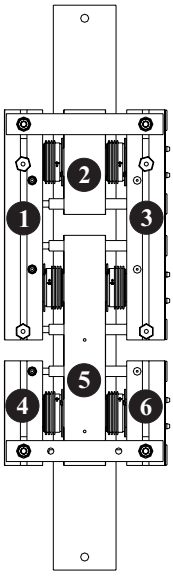


Table 1: Ohmmeter Position

Test	Ohm Meter Reading	Results	Value
From position 1 to position 2	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 2 to position 4	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 1 to position 5	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 4 to position 5	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	

⌘ **NOTE:** All four test functions only apply to a 4160V system. If testing a 2400V system, test only against position 1 versus 2 and 2 versus 4.

If all values are greater than 50K ohms, proceed to the SCR Gate to Cathode Test. If an SCR measures less than 50K ohms but not 0 ohms it is probably fine but would have to be measured for off state current flow to determine if it is good. If any of the recorded values are 0 ohms then one or more of the SCRs in that phase may have failed. An ohmmeter can only determine failed devices; an SCR tester is required to verify proper operation of the device.
(con't next page)

⌘ **NOTE:** If at any time during this procedure it is necessary to remove any of the red and white SCR gate leads from the firing card, care must be taken to insure that these leads are reconnected to the terminal they were removed from. If the gate leads are removed from the circuit board and the SCRs are tested a second time, the reading on the ohmmeter may be different.

Alternative Shorted SCR Test

This will test the anode to cathode integrity of the SCR. Measure the resistance between sets of red (cathode) leads on the right hand side of the firing card. The measured value should be greater than 50K ohms. Abnormally high or low values may indicate a failed SCR. To perform the SCR test, attach the ohmmeter to cathodes (red leads) of the SCR in the patterns shown below.

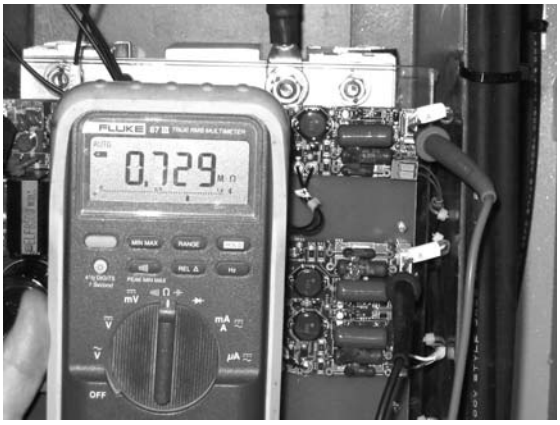


Figure 3
Meter Testing

With your ohmmeter, test each SCR cathode to SCR cathode (red to red wire). Perform this test on SCRs labeled A-B, C-D, E-F.

Table 2

Test	Ohm Meter Reading		Value
A and B Pair	Greater than 50 kΩ Less than 50 kΩ	Pass Fail	
C and D Pair	Greater than 50 kΩ Less than 50 kΩ	Pass Fail	
E and F Pair	Greater than 50 kΩ Less than 50 kΩ	Pass Fail	

⌘**NOTE:** The E and F test only applies to tests on 4160V systems.

Shorted SCR Found

If all values are greater than 50K ohms, proceed to the SCR Gate to Cathode Test. If an SCR measures less than 50K ohms but not 0 ohms it is probably fine but would have to be measured for off state current flow to determine if it is good. If any of the recorded values are 0 ohms then one or more of the SCRs in that phase may have failed. An ohmmeter can only determine failed devices; an SCR tester is required to verify proper operation of the device. If a shorted SCR was found during the Alternative Shorted SCR Test, the cards and jumpers will need to be removed at this point in order to test each SCR to find the one that has shorted. Refer to figure 2 on page 108 and table 3 to place the ohmmeter cables.

Table 3: Ohmmeter Position for Shorted SCR

Test	Ohm Meter Reading	Results	Value
From position 1 to position 2	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 2 to position 3	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 1 to position 5	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 5 to position 3	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 4 to position 5	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	
From position 5 to position 6	Greater than 50 kΩ	Pass	
	Less than 50 kΩ	Fail	

SCR Gate to Cathode Test

To perform the gate to cathode test, attach the ohmmeter to SCRs like in the picture shown below to measure the resistance between the red and white SCR gate leads. If the leads are removed from the control board care must be taken to insure that these leads are reconnected to the terminal they were removed from. If the leads are removed and tested a second time the readings on the ohmmeter may be different.

Table 5

Test	Ohm Meter Reading	Results
Gate to cathode for each SCR	8 Ω to 50 Ω	Pass
	Less than 8 Ω and more than 50 Ω	Fail

Figure 4

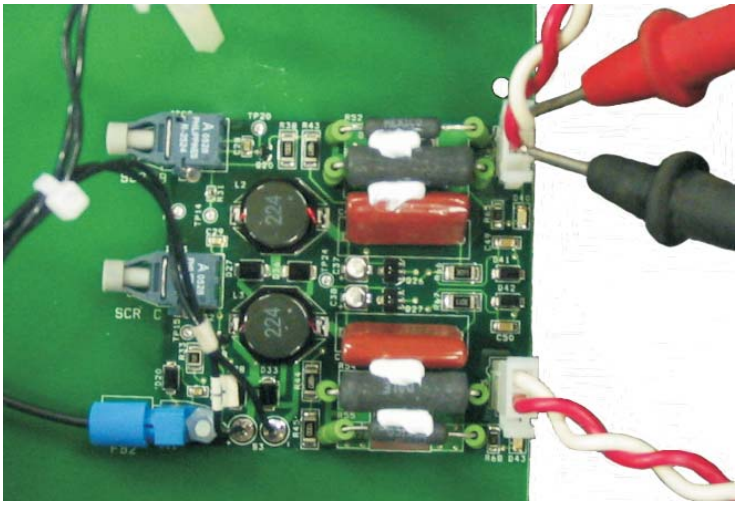


Table 4: Ohm Meter Recordings

Test	Ohm Meter Reading		
SCR	Phase 1	Phase 2	Phase 3
SCR A	ohms	ohms	ohms
SCR B	ohms	ohms	ohms
SCR C	ohms	ohms	ohms
SCR D	ohms	ohms	ohms
SCR E	ohms	ohms	ohms
SCR F	ohms	ohms	ohms

If all values are greater than 50 ohms, proceed the SCR Test. If an SCR measures less than 8 ohms but not 0 ohms it is probably fine but would have to be measured for off state current flow to determine if it is good. If any of the recorded values are 0 ohms then one or more of the SCRs in that phase may have failed. An ohmmeter can only determine failed devices; an SCR tester is required to verify proper operation of the device. Remove each SCR in the phase and measure across the anode to cathode to determine which device is defective. Keep in mind that the "hockey puck" style SCR's have to be compressed when measuring.

⌘ **NOTE:** If at any time during this procedure it is necessary to remove any of the red and white SCR gate leads from the firing card, care must be taken to insure that these leads are reconnected to the terminal they were removed from. If the gate leads are removed from the circuit board and the SCRs are tested a second time, the reading on the ohmmeter may be different.

⌘ **NOTE**: If at any time these resistance readings are outside of the above specified values consult factory.

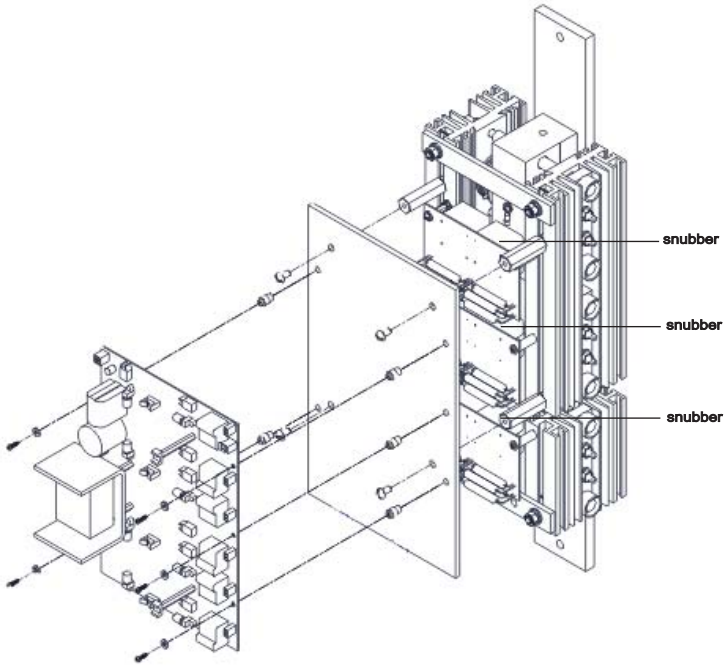
SCR Replacement

Card Removal

Before the SCR's can be removed, the PC boards and Lexan™ or glastic must first be removed. If unsure of any wiring connections to the card, write down location of wires on drawings.

Next, remove the snubbers (refer to figure 5).

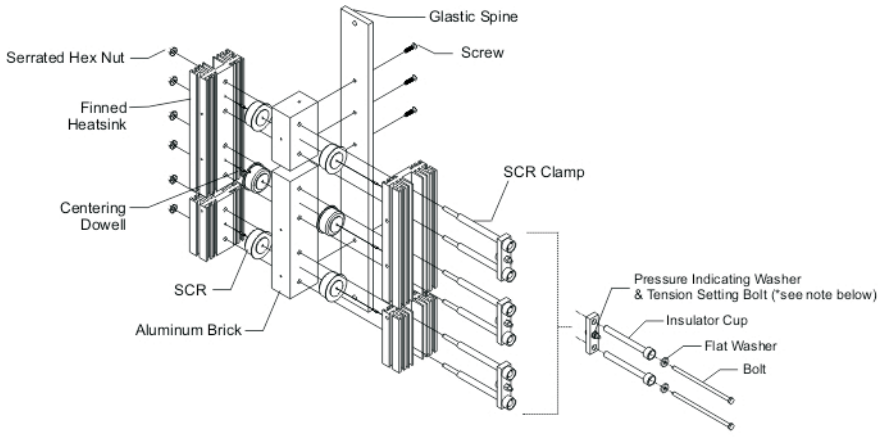
Figure 5: Lexan™/Glastic & Card Assembly



SCR Clamp

The SCR clamp pictured below is typical of the clamp used on all SCRs. The larger SCRs have two spring washer stacks and pressure indicating washers. These SCR clamps are precision clamps that allows easy installation to the proper SCR clamping pressure. They have a pressure indicator(s) that will become loose once the proper pressure is reached.

Figure 6: Clamp Assembly



⌘ **NOTE: Do not adjust pressure indicating washer. If it is adjusted or tampered with the clamp is defective and must be returned to factory for calibration.**

ATTENTION: The Fiber Optic cables can be damaged if struck or bent sharply. The edge of the printed circuits board should be held to prevent damage. Special equipment is required for working on the fiber optic portion of the starter. Please contact Benshaw for service in this area.

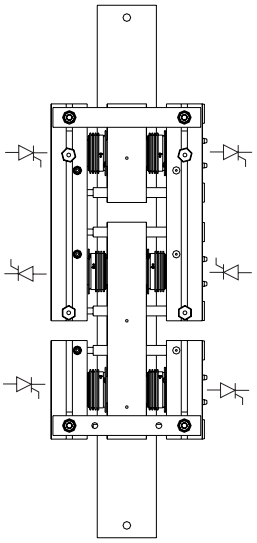
SCR Removal

To remove the SCR from heatsink, loosen the two bolts at each end of the clamp body. The SCR has a dowel pin centering it in the heat sink so the two bolts have to be loosened enough to allow it to clear this pin.
DO NOT loosen the nut on indicator washer. This will change the clamping pressure of the clamp and the clamp will be rendered defective.

SCR Installation

To install an SCR, use Benshaw approved SCR's. Coat the faces of the SCR's to be installed with a thin layer of electrical joint compound (EJC). Place the SCR's onto the dowel pins (refer to figure 6 on page 111 for proper SCR position). The SCR symbol has a triangle that points to the cathode. Assemble the insulator cups, washers and bolts as shown in the clamp diagram. Finger tighten nuts on the bolts until they are snug, ensuring that the bolts are evenly tightened and the clamp body is parallel to the heat sink. Tighten each bolt in 1/8 turn increments until the pressure indicator(s) can be turned on the bolt. This ensures the proper clamping pressure on the SCR.

Figure 7:



⌘ **NOTE:** For clamps with two washer stacks, it may be necessary to adjust (tighten or loosen) one or both bolts, until both indicators are even, allowing both washers to spin.

Re-Test SCR's

Once the SCR's have been replaced, perform another SCR Test Procedure.

Re-Assemble Unit

When the SCR readings are correct, re-install the PC boards, RC snubber, and Lexan™ or glastic. Make certain that all wiring is done correctly, and re-install the phase in the unit it was taken from.

Built-In Self Test (BIST)

General

The RediStart Micro Medium Voltage starter has the capability to perform a test sequence to ensure it is operating properly. The test will operate the vacuum contactors and fire the SCR gates so that proper operation can be determined.

Before starting the Built-In Self Test, ensure that the disconnect is open. This test should not be performed until it has been verified that all three phases of the disconnect are open and lock out the disconnects.

⌘ **NOTE:** To do the gate firing test, the starter must have 120VAC supplied to the K1 relay (run command relay) on the power card. If the K1 relay does not energize during the test, the RediStart Micro may not fire the SCR gates.

Test Setup

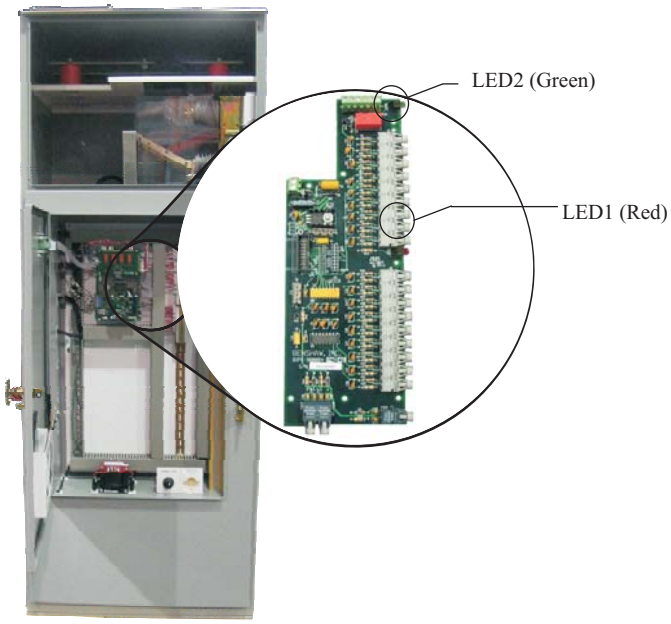
To perform the BIST, open the control panel door to connect 120VAC to the test plug. Move the Normal/Test switch to the Test Position and verify that the power LED (LEDC2) on the Micro II CPU card is lit.

Figure 8: Normal/Test Switch

Verify the following on the fiber optic transmitter card:

LED1 (Power, Red) when lit
LED2 (OK Status, Green) when lit

Figure 9: Fiber Optic Transmitter Card (BIPC-300004--04)



Open the medium voltage door and verify the operation of the Power LED (GREEN / D2) as well as the 12 volt healthy LED (GREEN / D9) for the fiber optic cable on each of the fiber optic boards. To visually see the Power light, look behind the elevated "U" shaped glastic that holds the transformer (refer to page 118).

BIST Notes

The display will indicate step by step the activity of the BIST operation throughout the test.

⌘ **NOTE:** To skip or move to the next activity of the BIST before the predetermined time has elapsed, press the Start button until the desired activity is present on the display screen.

The normal length of a BIST is 210 seconds. At the completion of the test the display will briefly read "BIST Complete Resetting System" and then return to the home screen.

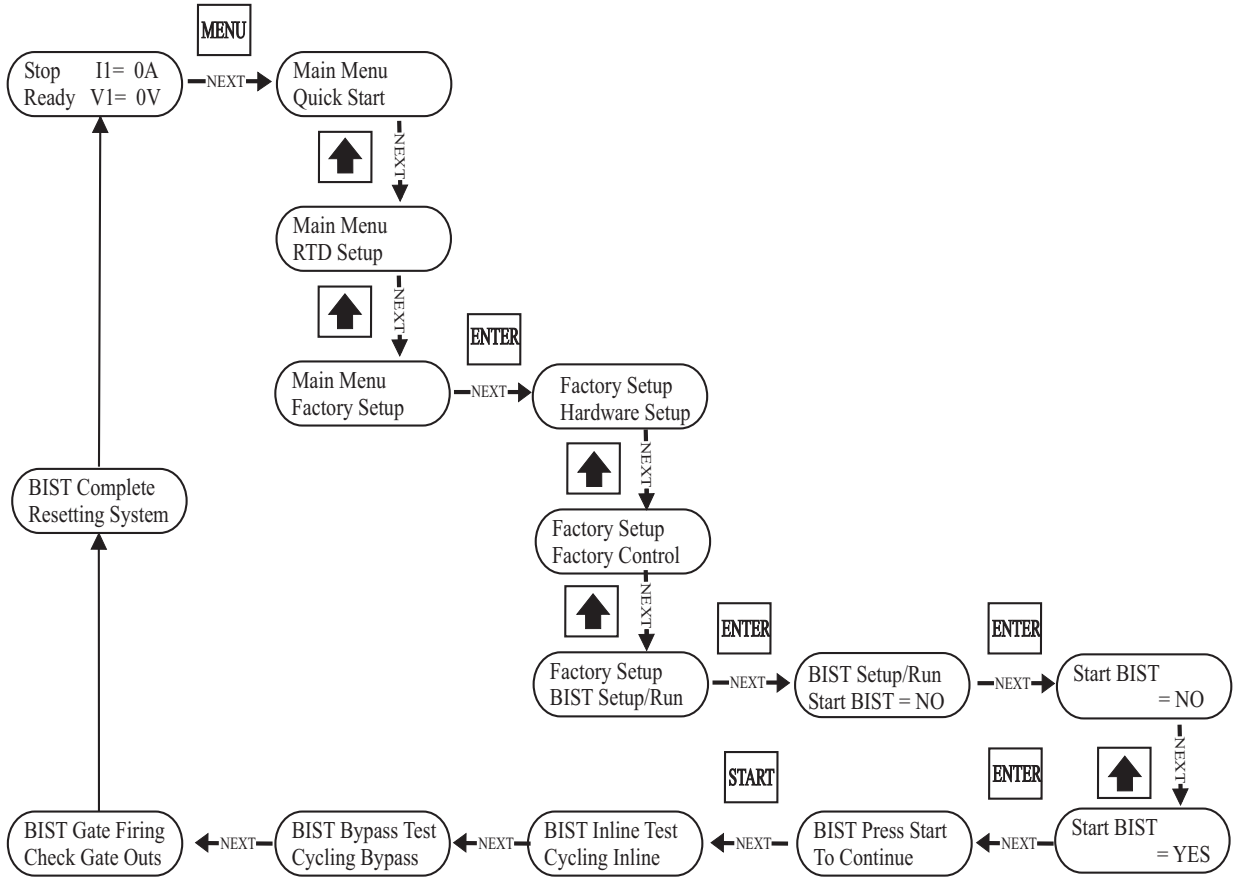
⌘ **NOTE:** If the power LED does not light up, check and verify the 28 VAC Transformer. If the transformer is functional then the gate driver card that does not have all of its SCR indicator lights operating has failed.

Figure 10: Fiber Optic Driver Card Location (BIPC-300047-X-X)

Conducting a BIST

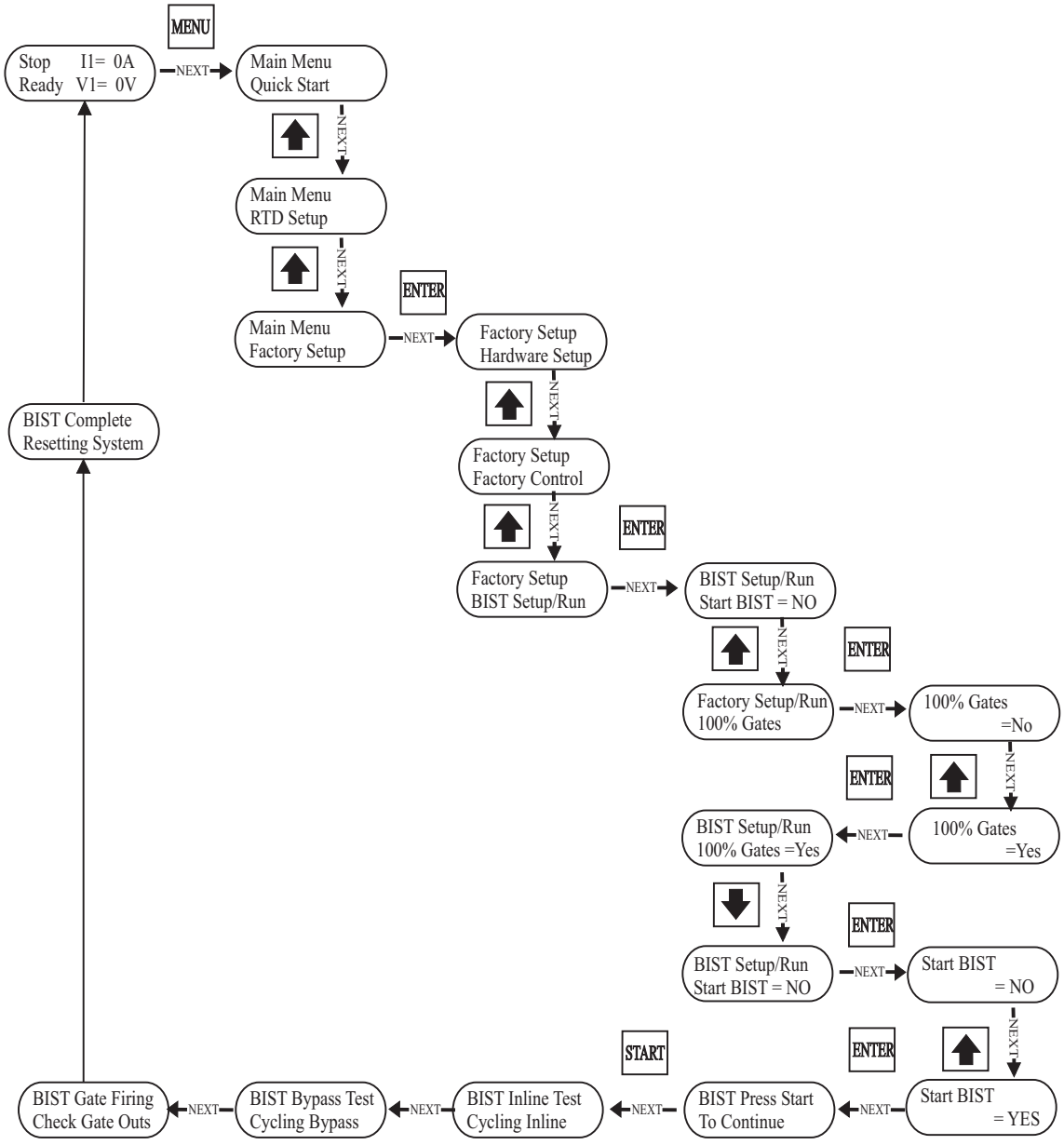
To conduct a **BIST with sequential SCR firing**, follow these steps:

- Press the [Menu] button to enter the menu system.
- Press the [Up] button twice to get to the Factory Setup screen.
- Press the [Enter] button to access the Factory Setup menu.
- Press the [Up] button twice to get to the BIST Setup/Run screen.
- Press the [Enter] button to access the BIST Setup/Run menu.
- Press the [Enter] button to access the Start BIST sub-menu.
- Press the [Up] button to display Start BIST = Yes
- Press the [Enter] button allow the change.



To conduct a **100% Gates BIST**, follow these steps:

- Press the [Menu] button to enter the menu system.
- Press the [Up] button twice to get to the Factory Setup screen.
- Press the [Enter] button to access the Factory Setup menu.
- Press the [Up] button twice to get to the BIST Setup/Run screen.
- Press the [Enter] button to access the BIST Setup/Run menu.
- Press the [Up] button once to access the Factory Setup/Run 100% Gates screen.
- Press the [Enter] button to access the 100% gates menu.
- Press the [Up] button to display 100% Gates = Yes
- Press the [Enter] button to allow the change.
- Press the [Down] button to return to the BIST Setup/Run menu.
- Press the [Enter] button to access the Start BIST sub-menu.
- Press the [Up] button to display Start BIST = Yes
- Press the [Enter] button to allow the change.



Begin BIST Test

Once started, the RediStart Micro will log a Code 47 - BIST Started in the event recorder and check the state of the disconnect switch. If the disconnect switch is closed, the RediStart Micro will display:

Self Test (BIST)
Open Disconnect

Otherwise, the RediStart Micro determines that the disconnect switch is open and it will indicate that it is ready to begin the BIST.

Self Test (BIST)
Press Start

To begin the BIST process, press the display Start button. To skip any part of the test and proceed to the next section, press the Start button again.

In-line Test

The RediStart Micro will begin the test sequence by operating the in-line contactor three times and monitoring the 120VAC feedback for proper operation. If the in-line contactor fails to operate, the RediStart Micro will display a Fault#77 - In-Line Fault and log a code 77 in the event recorder. During the in-line contactor test, the RediStart Micro will display the following:

BIST Inline Test
Cycling Inline

Bypass Test

The RediStart Micro will then test the bypass contactor by operating it three times and monitoring the 120VAC feedback for proper operation. If the bypass contactor fails to operate, the starter will display a Fault#73 - Bypass Fault and log a code 73 in the event recorder. During the bypass test, the RediStart Micro will display the following:

BIST Bypass Test
Cycling Bypass

Gate Firing Test

The final test that the RediStart Micro will perform is an SCR gate firing test. The RediStart Micro's default test method sequentially fires the SCR gates for 210 seconds, following the sequence listed in table 5. Examine the fiber optic gate driver cards to ensure all of the gate LEDs come on at the proper time.

BIST Gate Firing
Check Gate Outs

⌘ **NOTE:** To do the gate firing test, the starter must to have 120VAC supplied to the K1 relay (run command relay) on the power card. If the K1 relay does not energize during the test, the RediStart Micro may not fire the SCR gates.

The medium voltage starter has three gate driver cards that work in sequence with each other. The table on page 118 illustrates the order in which the gates will fire. Each phase is broken into two parts to form a segment of the sequence in which the phase order follows. In part one, the LED indicator lights labeled A, C and E will fire simultaneously for one second. In part two the LED indicator lights labeled B,D and F will also fire simultaneously for one second. Once all six LED indicator lights have fired in turn completing the segment, phase one is complete. Phase two will then commence. Phase two and three repeat the same functions.

⌘ **NOTE:** If the LED indicator lights do not fire in this sequence consult a Benshaw service representative.

Table 6: Gate Firing Sequence

Step	Gates Fired
1	Phase 1 - A, C, E
2	Phase 1 - B, D, F
3	Phase 2 - A,C, E
4	Phase 2 - B, D, F
5	Phase 3 - A, C, E
6	Phase 3 - B, D, F

⌘ **NOTE:** The gate firing sequence shown above is a three phase pattern illustrating the firing procedure of a 4160V system. If operating a 2400V system the sequence will not include the gate testing of the E and F positions.

* If it does not follow this sequence consult factory.

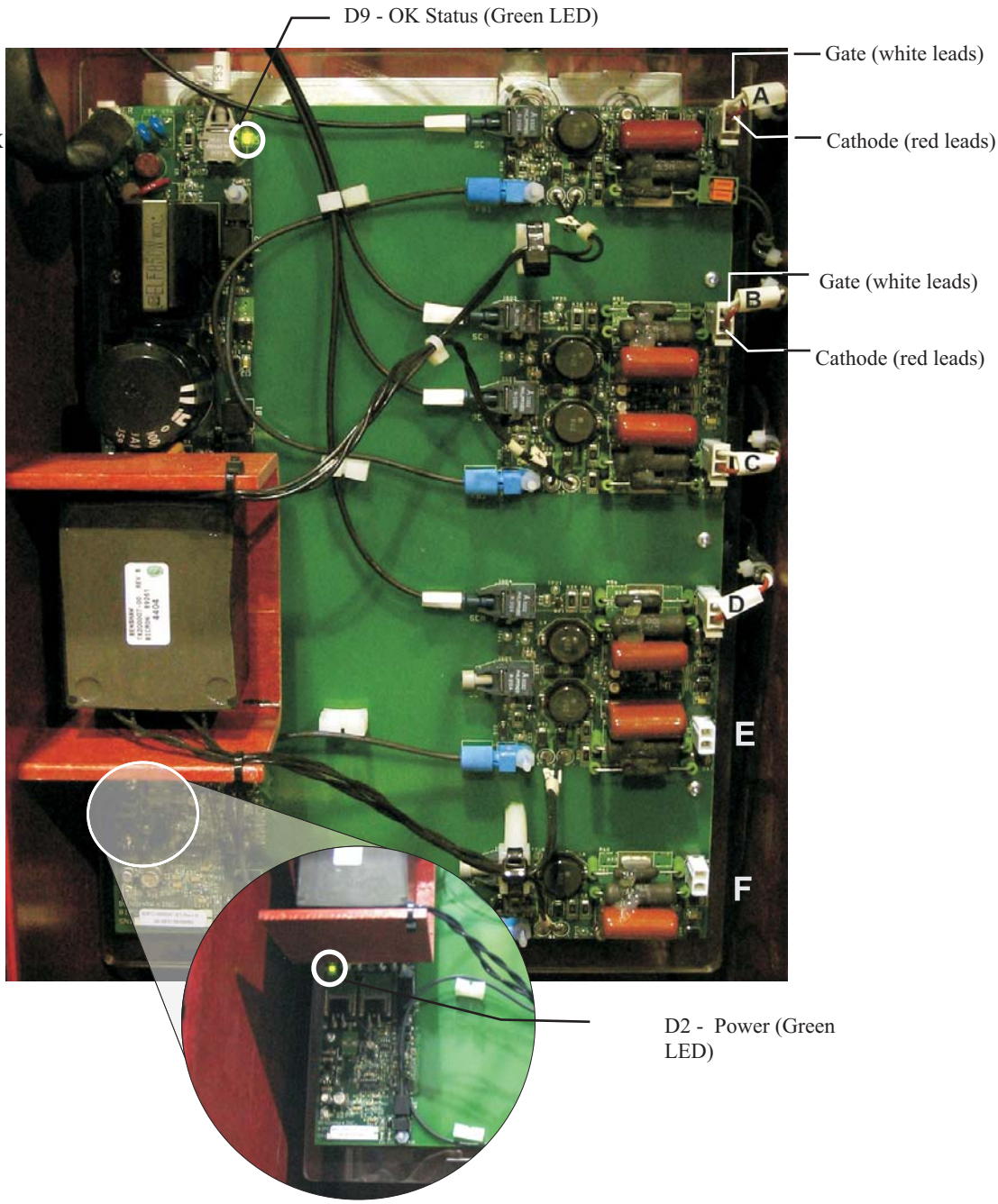


Figure 11: Gate Driver Card BIPC-300047-X-X

100% Gate Firing

The 100% Gate Firing is an optional setting. The RediStart Micro will test all the SCR gates simultaneously. To activate this option the 100% Gate Test must be turned On from its default Off setting.

The gate voltage can be measured with a DC voltmeter. The voltage on each SCR (red and white twisted pair) should be between 0.5 and 2.0 VDC. If the desired voltages are not achieved consult the factory.

The BIST procedure limits this test to 210 seconds. The waiting period between tests is a minimum of 15 minutes for cool down period.

⌘ **NOTE:** Once the 100% Gate Firing test has completed and the system has reset, be sure to manually verify and reset the BIST to Sequence Control (by setting the 100% Gate back to No). Repetitive testing with 100% could cause damage to the system.

Test the voltages between the red and white gate leads.

Table 7

100% Gate Reading Chart (0.5 to 2.0 VDC)			
SCR Gate	**Phase One**	**Phase Two**	**Phase Three**
A			
B			
C			
D			
E			
F			

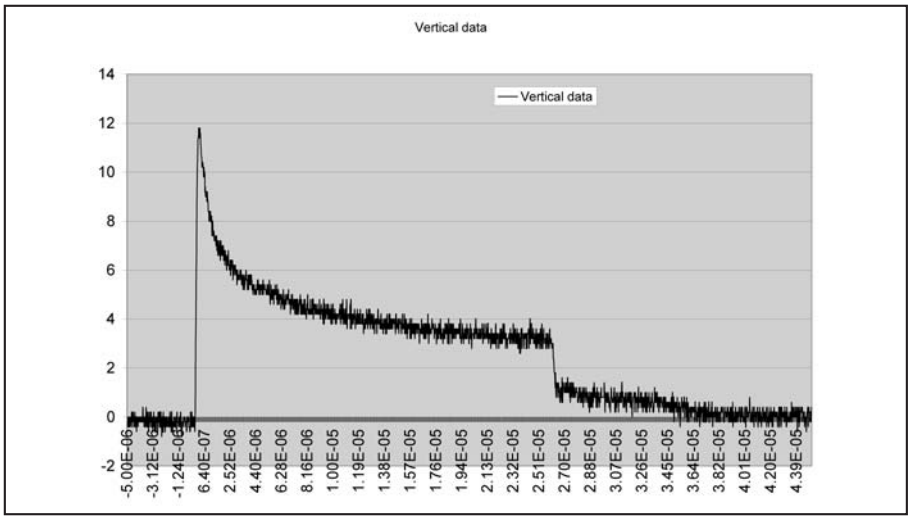
⌘ **NOTE:** If operating a 2400VAC system the 100% Gates will not include the Gate testing of E and F.

Oscilloscope Troubleshooting

The gate voltage waveform may also be viewed with an oscilloscope. If the test cannot be completed within the 210 seconds, a 15 minute cool down period is required.

- Place oscilloscope on the 2msec time scale and 1 volt per division.
- Connect the +ve oscilloscope probe to the white gate lead and the -ve probe to the red cathode lead.
- Verify all gating signals to each SCR. See drawing below for correct waveform.

Figure 12: Sample Gate Signal Check



- If any bad waveform(s) are found write down the location and call the factory for further assistance.

Resetting System

After the completion of the BIST Test the RediStart Micro registers a code 47 - BIST Complete in the event recorder and automatically resets the system. The following will be temporarily shown on the display while the system resets.

BIST Complete
Resetting System

BIST Test Canceled

If, for any reason during the test, the disconnect is closed, power is applied, or the BIST command is removed, the RediStart Micro will stop the test, log a code 46 - BIST Canceled, and display:

FAULT#46
BIST Cancelled

High Pot Test

High Pot Testing

Consult Factory

Vacuum Contactor

Vacuum Contactor

Consult factory for manual.

Optional RTD Module Troubleshooting

If the system includes an optional RTD Module with an I/O board for communication control, verify that all three LED indicator lights on the remote RTD units are toggling, as well as the Driver Enable (DE / D4), Transmit Data (TxD / D5), Receive Data (RxD / D6), Heartbeat (LED1 / D3) and Watchdog (LED2 / D2).

⌘ **NOTE:** For more details see Remote RTD Module Manual Pub. # 890010-00-X.

Figure 13: RTD I/O Card (BIPC-300017-01)

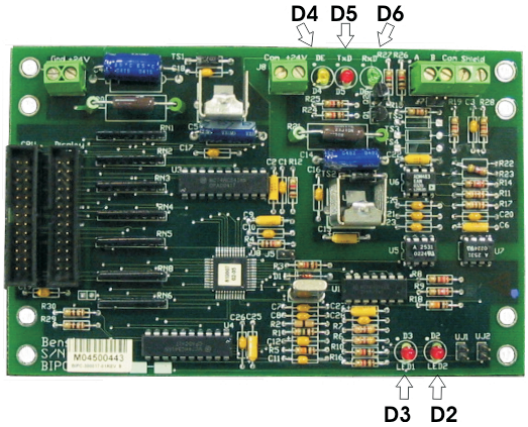
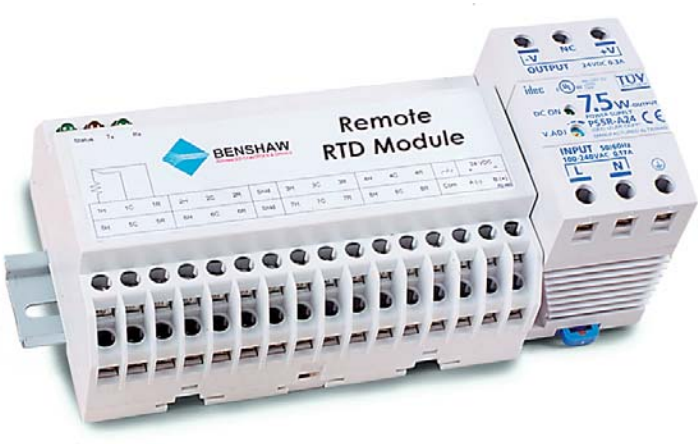


Figure 14: RTD Module (SPR-100P)



Local I/O Controller Card BIPC-300017-X-X	DE (Yellow)	Data Enable	On when card is transmitting data.
	TXD (Red)	Transmit Data	On when card is transmitting data.
	RXD (Green)	Receive Data	On when card is receiving data.
	LED1/D3 (Red)	Operation	Flashes when card is operating.
	LED2/D2 (Red)	Communication	On when valid data is received over the master link.
Remote RTD Module SPR-100P	TX (Red)	Transmit Data	On when card is transmitting data.
	RX (Green)	Receive Data	On when card is receiving data.
	Status (Green)	Operation	On when module measures RTD.

Notes:

7. MAINTENANCE

7.1 MAINTENANCE

MAINTENANCE

General

During the life of the RediStart Micro Medium Voltage, it may be necessary to perform routine maintenance on the unit. The following sections describe how to change a VACUUM contactor and power pole assembly.

Attention:

Servicing energized equipment can be hazardous. Sever injury or death may result from electrical shock or burn due to improper use of the equipment. It is recommended that the equipment is disconnected and a lock out command is enacted prior to any maintenance that is performed. Remember to allow any stored energy in the capacitors to dissipate. If it is necessary to work in the vicinity of energized equipment, the work practices of NFPA 70E, Electrical Safety Requirements for Employee Workplace, must be followed.

Periodical Inspection

Benshaw controls require only periodical inspections. These inspections can be visual for physical traces of dust, dirt or visible damage. Circuit boards should be physically tested to ensure that all the cables are connected properly.
Remember cleaning solvents should not come in contact with circuit or PC boards.
If filters or blowers are used, they should be cleaned or replaced as specified in the NEMA Standards Publication No. ICS 1.1 - 1987

Static

While performing maintenance on the RSM, certain preventative measures must be taken when handling or touching static sensitive components in the enclosure.

Most circuit boards and SCRs can be damaged by Electro-Static Discharge (ESD). If persons make contact with an ESD sensitive component during maintenance, they must be grounded. Grounding should be accomplished with a waist strap which is connected to an approved ground.

Attention:

Using other than factory recommended test equipment and instructions on the controls may result in personal injury and damage or failure of equipment.

Maintenance Records

Keeping good maintenance records will be helpful in locating possible intermittent problems by pointing to a particular area of recurring trouble within the system.

Vacuum Contactor

To remove either of the contactors, perform the following steps:

- Ensure that the main disconnect is open and the grounding blades are seated.
- Disconnect all power wire going to the VACUUM contactor poles.
- If necessary, remove the gray cover on the bottom of the contactor.
- Remove the control wires from the contactor.
- Undo the four mounting bolts and remove the contactor.

Replacement of the contactor is the reverse of the removal. Test the contactor before installing to ensure proper operation. A contactor manual is provided with each starter and should be referred to when disassembling and reassembling the contactor.
If required contact Benshaw for a manual.

Vacuum Bottles

The contacts in a vacuum bottle cannot be seen or examined directly. They rely on a high vacuum to operate properly and to interrupt current. Wear indicators must not be in the red zone when the contacts initially touch. Operate the contactor manually with a hex wrench to perform this test. Consult manufacturers instruction manual included with the starter for addition maintenance requirements.

Power Pole

To remove a SCR power pole, perform the follow steps:

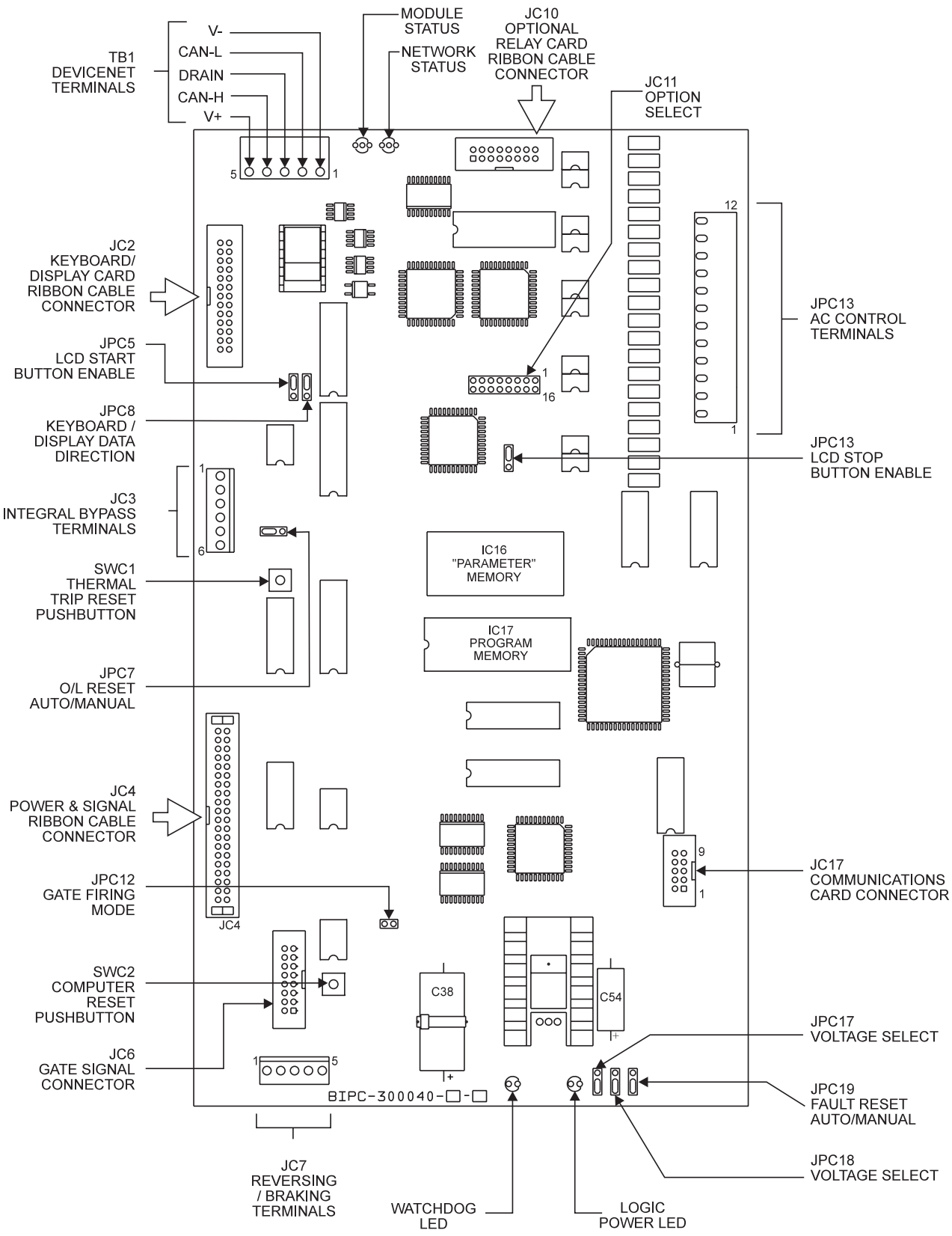
- Ensure that the main disconnect is open and the grounding blades are seated.
- Disconnect all power and control wiring going to the phase.
- Remove the two nuts, one top and one bottom, holding the phase in place.
- Carefully lift the phase from the enclosure, using caution to avoid damage to the control wiring.
- Once removed, contact Benshaw to have the phase serviced or exchanged.

	The installation of the power pole is the opposite of the removal process. The bypass contactor in the package is horsepower rated and can be used to operate the motor while the power pole is being serviced if the power system and mechanical system can hand across-the-line. If this is the case, ensure that the power wire for the removed phase is completely removed from the unit and that the control wiring is isolated and will not come into contact with any medium voltage to prevent damage to the starter.
Fans	Physically testing the fans by rotating and observing the fans for noise or binding will indicate if any failure is evident.
Interlocks	Verify that interlocks functions as intended, and have not been forced, damaged or removed.
Barriers	Verify that all barriers are in place and securely fastened.
Disconnect Switch	Perform a visual inspection such as evidence of overheating, and do a tightness check. Consult manufacturers instruction manual included with the starter for addition maintenance requirements.

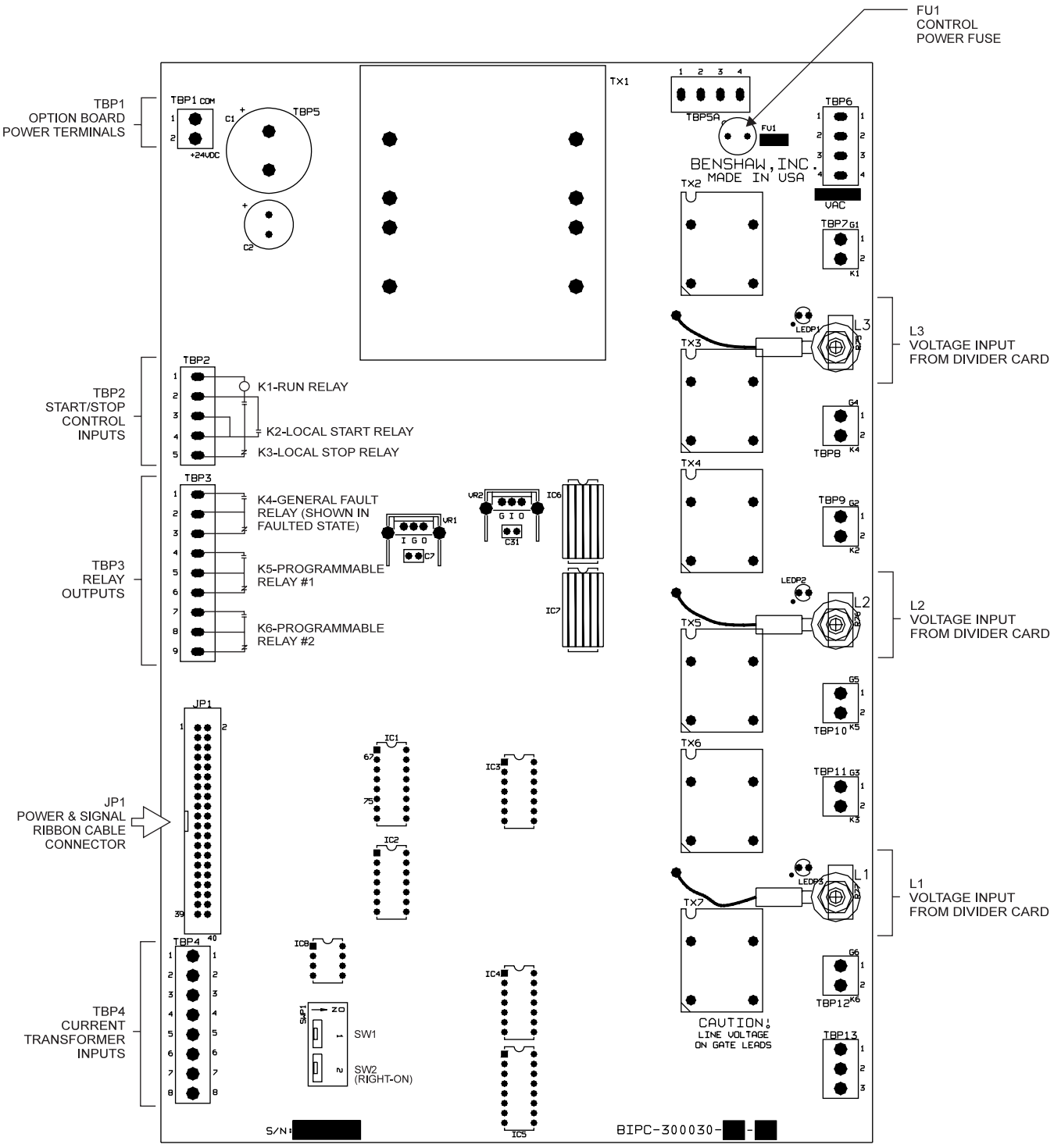
Notes:

8. DRAWINGS

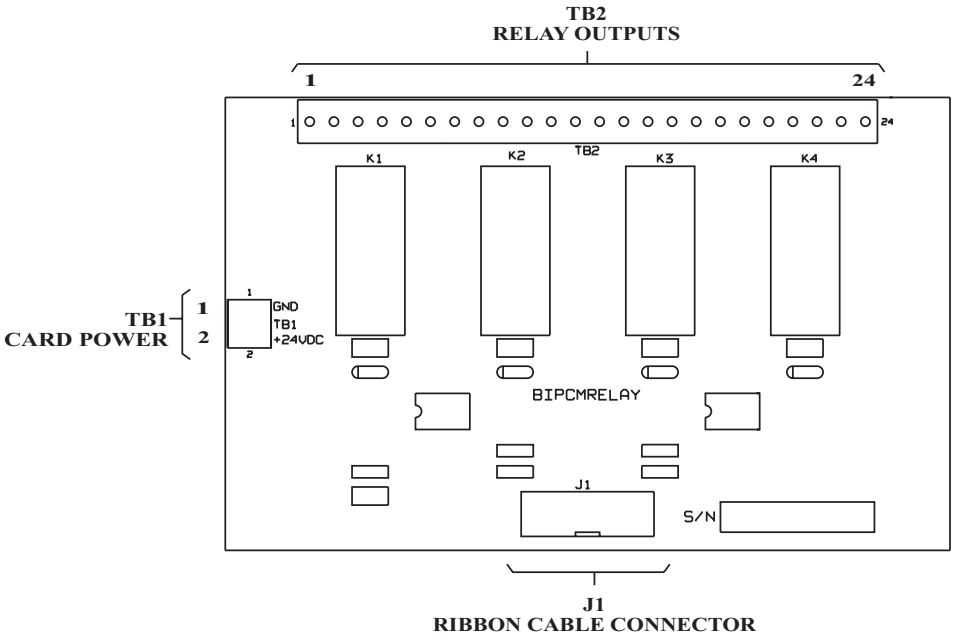
RediStart Micro II Computer Card Diagram



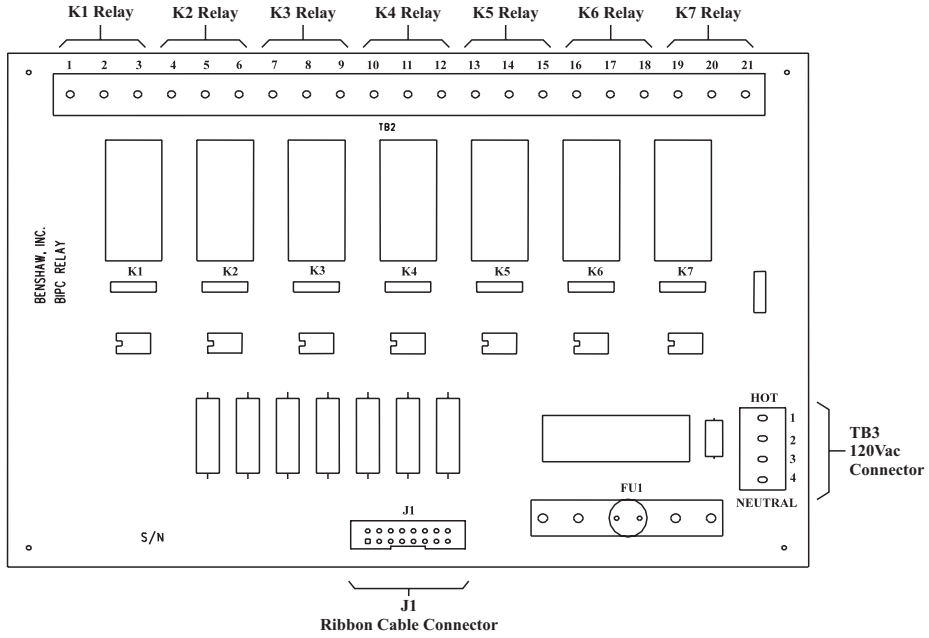
RediStart Micro II Power Card Layout



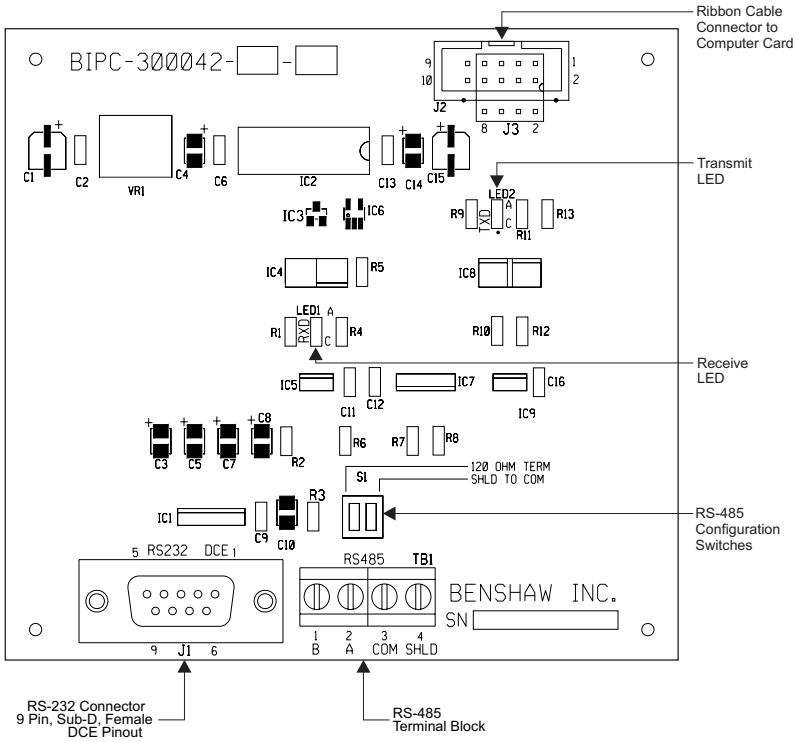
RediStart Micro II Four (4) Relay Card Layout



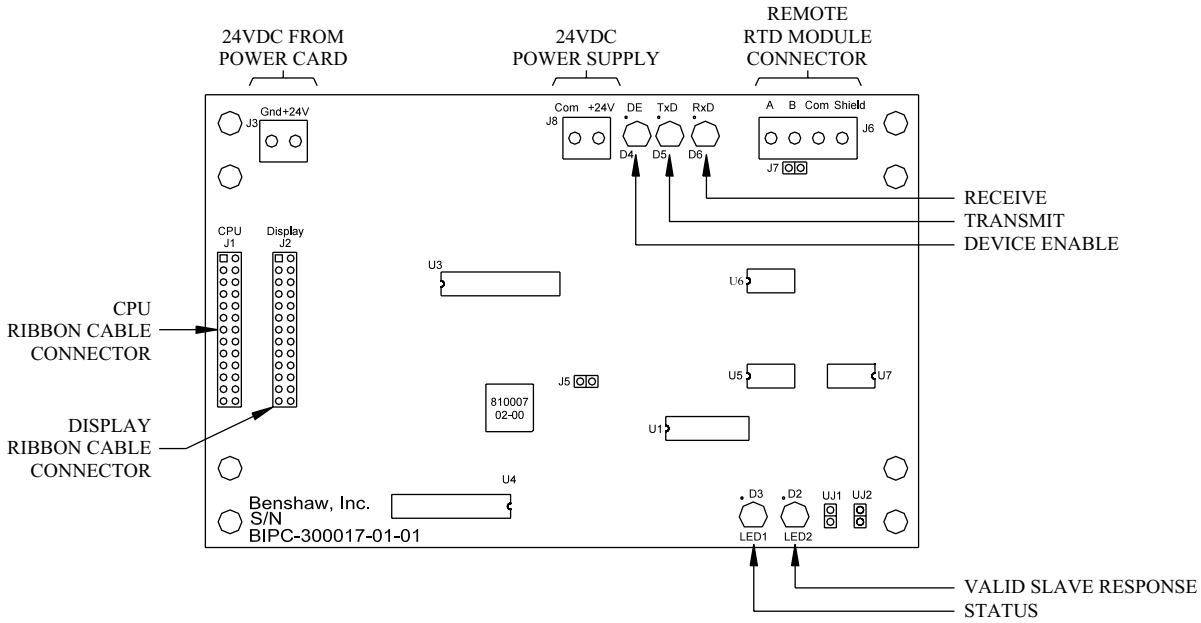
RediStart Micro II Seven (7) Relay Card Layout



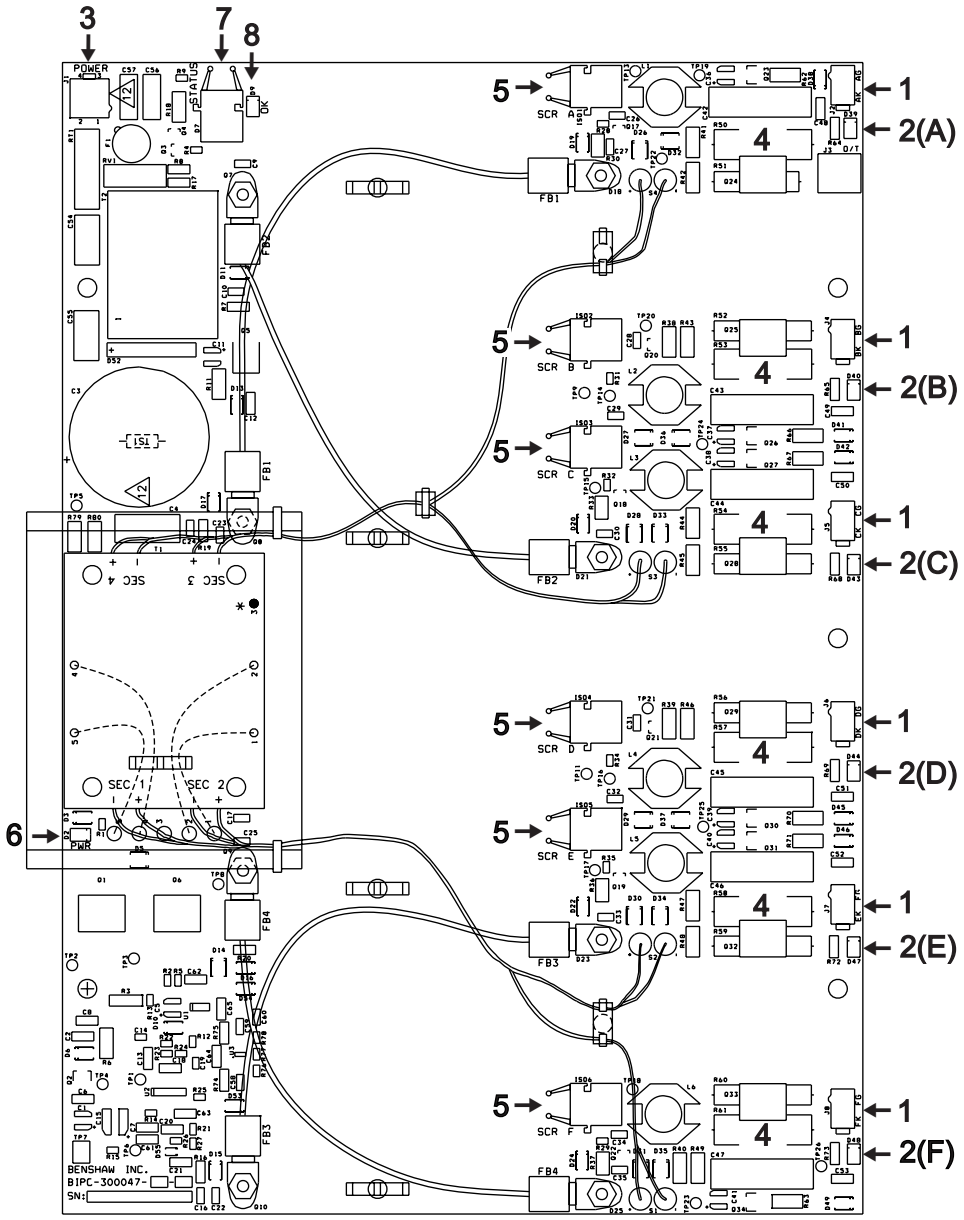
RediStart Micro II RS-232/485 Communications Card Layout



Local I/O Bus Controller Card (for Remote RTD Module)



Redistart Micro II Gate Driver Card

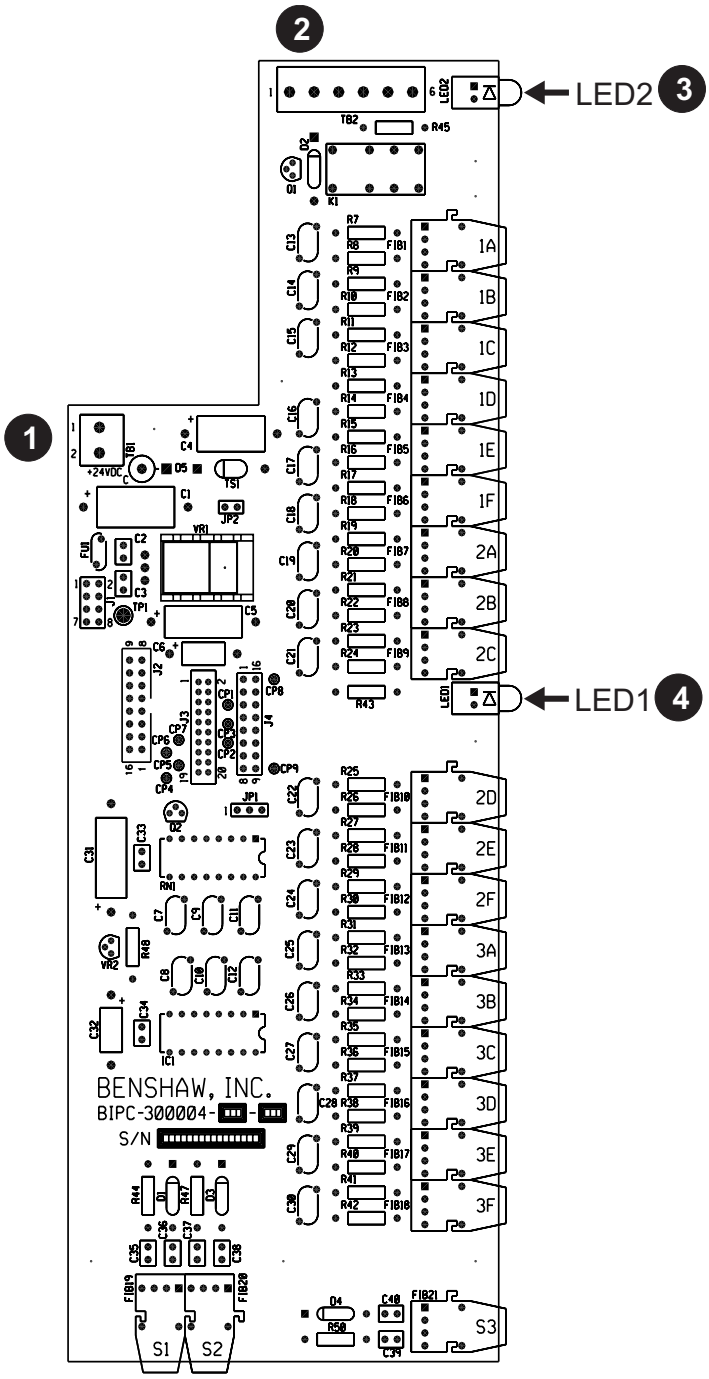


1 - SCR Gates
2 - LED indicator lights
3 - 28VAC Power Input
4 - Resisters
5 - Fiber Optic SCR connector
6 - Power On LED (under red glastic)
7 - Status / Health Connector
8 - OK LED

ATTENTION:

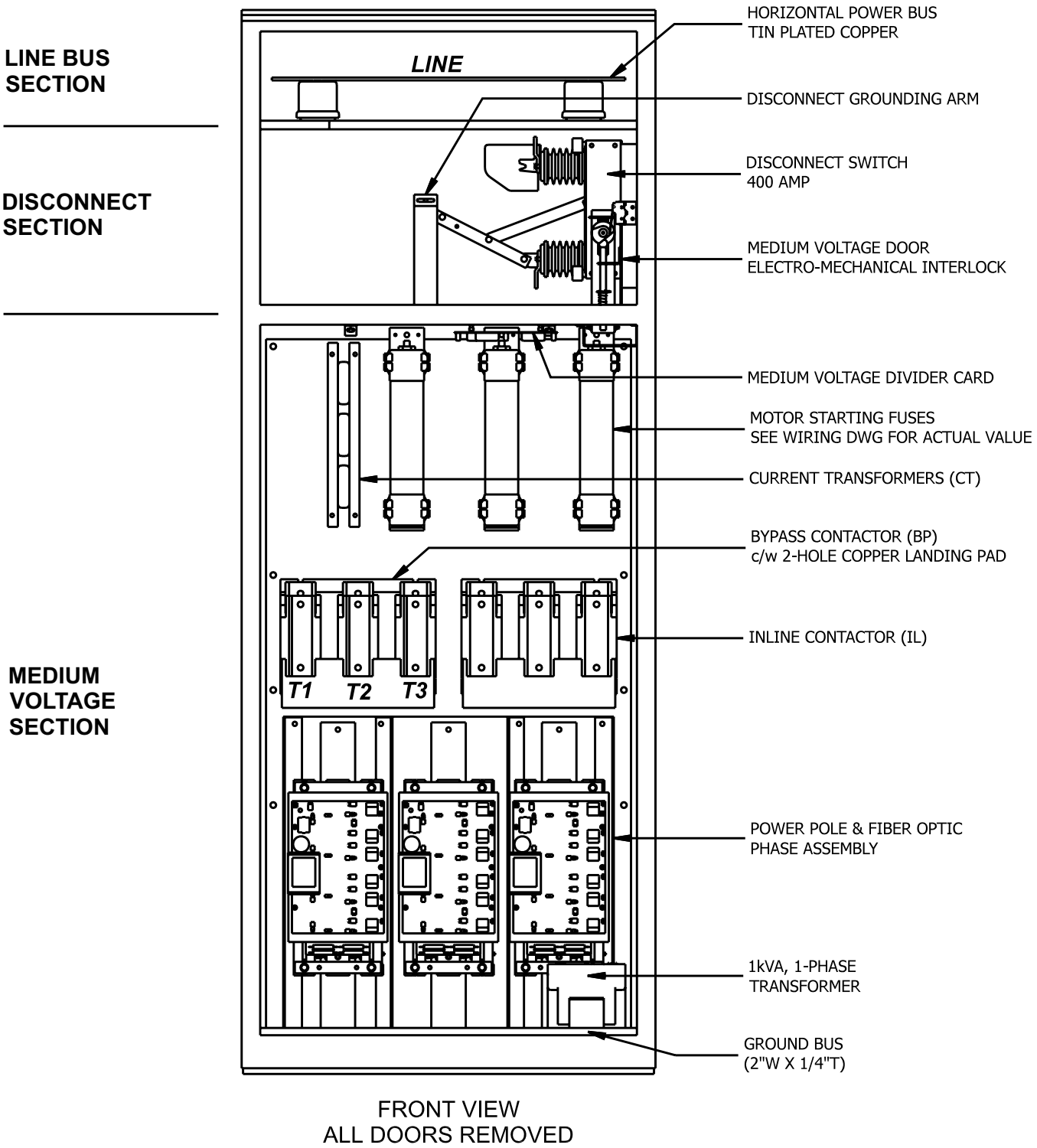
The Fiber Optic cables can be damaged if struck or bent sharply. The edge of the printed circuit board should be held to prevent damage.

RediStart Micro II Transmitter Board



1 - 24 VDC
2 - Fibre Optic Transmitter Card Relay Status
3 - Successful Feedback indicator LED 2 (Green)
4 - Power On indicator LED 1 (Red)

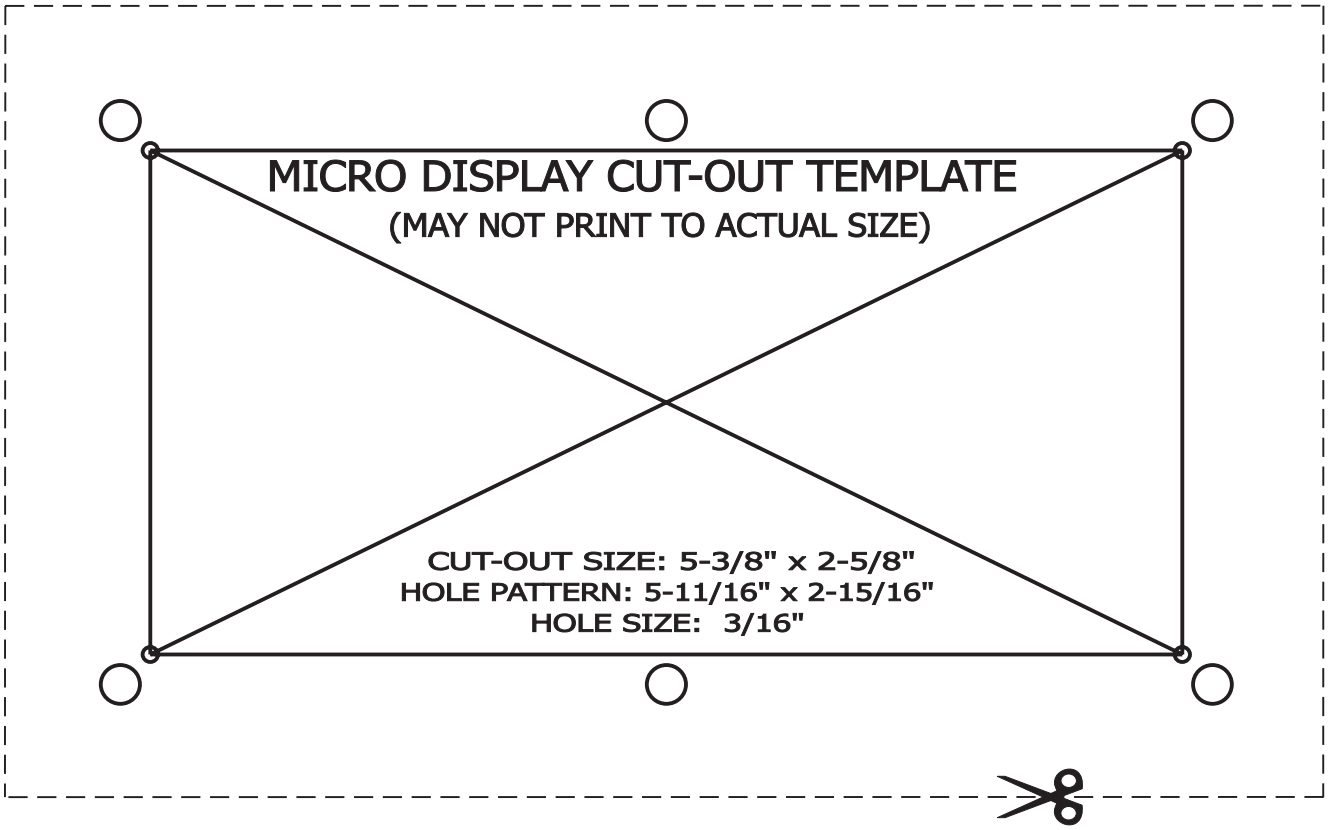
Sample RediStart Micro II MV Unit



FRONT VIEW
ALL DOORS REMOVED

⌘ **NOTE:** This is only a sample diagram drawing for component identification purposes. Component locations may change to meet end users specifications.

RediStart Micro II Display Cut-out



9. PARAMETER LIST

9.1 PARAMETER LIST

RediStart Micro II Parameter List

General

The following pages list the menu parameters for the RediStart Micro II. The list gives the page number where information on the parameter can be found. The list can also be used to record the values that are programmed into the RediStart Micro II for the installation.

Recording Parameters

Each line lists the parameter, page reference, blank, and default setting. The blank spot is for entering the programmed value so that a record of the entered parameters is kept. If the parameter can not be programmed then its value is listed.

NOTE: Not all starters have all of the listed parameters.

Quick Start

	Parameter	Page	Range	Step	Unit	Default	User Setting
Quick Start	Motor FLA	47	1-4000	1	Amp	1	_____
	Serv. Fact	47	1.00-1.99	0.01	%	1.15	_____
	Start Mode	47	Curr, TT, KW, Tach	-	-	Curr	_____
	Stop Mode	47	Coas,VDCL,TT	-	-	Coas	_____
	Int. Curr.	48	50-400	1	%	100	_____
	Max. Curr.	48	100-600	1	%	600	_____
	Ramp Time	48	0-120	1	sec.	15	_____
	Overload	49	1-40	1	-	10	_____
	Phase Orde	49	INS,ABC,CBA	-	-	INS	_____

Motor Nameplate

	Parameter	Page	Range	Step	Unit	Default	User Setting
Motor Nameplate	Motor FLA	50	1-4000	1	Amps	1	_____
	Serv. Fact	50	1.00-1.99	0.01	%	1.15	_____
	Motor RPMs	50	1-3600	1	RPM	1760	_____

Starter Setup

	Parameter	Page	Range	Step	Unit	Default	User Setting
Starter Modes	Start Mode	51	Curr, TT, KW, Tach	-	-	Curr	_____
	Stop Mode	51	Coas,VDCL,TT	-	-	Coas	_____

	Parameter	Page	Range	Step	Unit	Default	User Setting
Forward1 Profile	Int. Curr.	52	50-400	1	%	100	_____
	Max. Curr.	52	100-600	1	%	600	_____
	Ramp Time	52	0-120	1	sec.	15	_____
	Kick Curr.	51	100-600	1	%	300	_____
	Kick Time	51	Off,0.1-10.0	0.1	sec.	Off	_____

	Parameter	Page	Range	Step	Unit	Default	User Setting
Forward2 Profile	Int. Curr.	54	50-400	1	%	100	
	Max. Curr.	54	100-600	1	%	600	
	Ramp Time	54	0-120	1	sec.	15	
	Kick Curr.	55	100-600	1	%	300	
	Kick Time	55	Off,0.1-10.0	0.1	sec.	Off	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Tachometer Setup	FS Volts	56	1.00-7.00	1	-	5.00	
	Stab Cnst.	56	10-150	1	sec.	100	
	Ramp#1 Tim	56	0-120	1	sec.	15	
	Ramp#2 Tim	56	0-120	1	sec.	15	
	TLoss Dela	57	0.1-90.0	-	sec.	1.5	
	TLoss Mode	57	TT,Curr,Shut	-	-	Shut	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Decel Setup	V Level #1	58	10-100	1	%	40	
	V Level #2	58	1-99	1	%	20	
	V DCL Time	58	0-60	1	sec.	0	
	TT DCL Tim	59	0-100	1	sec.	0	
	TT DCL Tor	59	1-100	1	%	10	

	Parameter	Page	Range	Step	Unit	Default	User Setting
PORT Ctl Setup	Fault Dly	60	OFF,0.1-90.0	0.1	sec.	OFF	
	Bypass Dly	60	OFF,0.0-3.0	0.1	sec.	0.0	
	Sense Time	60	0.01-0.50	0.01	sec.	0.05	

	Parameter	Page	Range	Step	Unit	Default	User Setting
TruTorque / KW Ramp	Int Tor / KW	61	1-100	1	%	20	
	Max Tor / KW	61	10-325	1	%	105	
	Ramp Time	61	0-120	1	sec.	15	
	TT / KW O Cu	62	Off,100-800	1	%	Off	
	Ovr Cur Dl	62	0.1-90.0	0.1	sec.	0.1	
	Rated M PF	62	0.00-1.00	0.01	P.F.	0.92	

9.1 PARAMETER LIST

Motor Protection

	Parameter	Page	Range	Step	Unit	Default	User Setting
Overload Class	Overload	63	1-40	1	-	10	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Line Current	% Imbalanc	64	10-40	1	%	15	
	Imbal Dela	64	0.1-90.0	0.1	sec.	0.5	
	@ Stop Dly	64	0.1-10.0	0.1	sec.	1.5	
	% No C@Run	65	2-40	1	%	5	
	No C@R Dly	65	0.1-90.0	0.1	sec.	1.0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Line Voltage	H/L Volts	66	10-30	1	%	20	
	Delay Time	66	0.1-3.0	0.1	sec.	0.5	
	PH Dect Dl	66	0.3-5.0	0.1	sec.	0.8	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Line Frequency	High Freq.	67	72-24	1	hz	72	
	Low Freq.	67	23-71	1	hz	23	
	Freq Delay	67	0.1-90.0	0.1	sec.	0.1	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Ground Fault	GND Fault	68	Off,1-100	1	A	Off	
	GND Delay	68	0.1-90.0	0.1	sec.	1.0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Shorted SCR	@ Ramp DLY	69	0.1-90.0	0.1	sec.	0.2	
	@ Stop DLY	69	0.1-90.0	0.1	sec.	1.0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Over Curr. Trip	Current	70	50-800,Off	1	%	Off	
	Detect Dly	70	0.1-90.0	0.1	sec.	0.1	
	Release Dl	70	1.0-90.0	0.1	sec.	10.0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Under Curr. Trip	Current	71	Off,10-100	1	%	Off	
	Detect Dly	71	0.1-90.0	0.1	sec.	0.1	
	Release Dl	71	1.0-90.0	0.1	sec.	10.0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Start Lockouts	Starts/Hou	72	Off, 1-20	1	#	Off	
	Time Start	72	Off, 1-600	1	min.	Off	
	BKS Timer	72	Off, 1-200	1	min.	Off	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Starting Timers	UTS Timer	73	Off,1-300	1	sec.	30	
	Zero Speed	73	Off,1-30	1	sec.	Off	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Permissive Input	In-line	74	1-10	1	sec.	4	
	Bypass	74	1-10	1	sec.	4	
	Trip Input	74	0.1-90.0	0.1	sec.	0.5	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Misc.	Phase Orde	75	INS,ABS,CBA	-	-	INS	
	# Auto RST	75	1-5	1	#	4	
	No Main PW	75	1-5	1	sec.	1	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Fault Classes	Fault# 1	76	see text	-	-	NonC	
	Fault# 2	76	see text	-	-	NonC	
	Fault# 3	76	see text	-	-	NonC	
	Fault# 4	76	see text	-	-	NonC	
	Fault# 5	76	see text	-	-	NonC	
	Fault# 6	76	see text	-	-	NonC	
	Fault# 7	76	see text	-	-	NonC	
	Fault# 8	76	see text	-	-	NonC	
	Fault# 9	76	see text	-	-	NonC	
	Fault#15	76	see text	-	-	Crit	
	Fault#16	76	see text	-	-	Crit	
	Fault#17	76	see text	-	-	NonC	
	Fault#18	76	see text	-	-	NonC	
	Fault#19	76	see text	-	-	NonC	
	Fault#20	76	see text	-	-	NonC	
	Fault#21	76	see text	-	-	NonC	
	Fault#22	76	see text	-	-	NonC	
	Fault#23	76	see text	-	-	NonC	
	Fault#24	76	see text	-	-	NonC	
	Fault#25	76	see text	-	-	NonC	
	Fault#26	76	see text	-	-	NonC	
	Fault#27	76	see text	-	-	NonC	
	Fault#28	76	see text	-	-	NonC	
	Fault#29	76	see text	-	-	Crit	
	Fault#30	76	see text	-	-	Crit	
	Fault#31	76	see text	-	-	NonC	
	Fault#46	76	see text	-	-	NonC	
	Fault#49	76	see text	-	-	Crit	
	Fault#50	76	see text	-	-	Crit	

Fault#51	76	see text	-	-	NonC	_____
Fault#52	76	see text	-	-	Crit	_____
Fault#53	76	see text	-	-	NonC	_____
Fault#54	76	see text	-	-	NonC	_____
Fault#56	76	see text	-	-	NonC	_____
Fault#64	76	see text	-	-	NonC	_____
Fault#65	76	see text	-	-	NonC	_____
Fault#66	76	see text	-	-	NonC	_____
Fault#68	76	see text	-	-	NonC	_____
Fault#69	76	see text	-	-	Dis	_____
Fault#70	76	see text	-	-	NonC	_____
Fault#71	76	see text	-	-	NonC	_____
Fault#72	76	see text	-	-	Crit	_____
Fault#73	76	see text	-	-	NonC	_____
Fault#74	76	see text	-	-	NonC	_____
Fault#75	76	see text	-	-	NonC	_____
Fault#76	76	see text	-	-	NonC	_____
Fault#77	76	see text	-	-	NonC	_____
Fault#78	76	see text	-	-	NonC	_____
Fault#79	76	see text	-	-	NonC	_____
Fault#90	76	see text	-	-	Crit	_____
Fault#91	76	see text	-	-	Crit	_____
Fault#92	76	see text	-	-	Crit	_____
Fault#93	76	see text	-	-	Crit	_____
Fault#94	76	see text	-	-	Crit	_____
Fault#95	76	see text	-	-	Crit	_____
Fault#96	76	see text	-	-	Crit	_____
Fault#97	76	see text	-	-	Crit	_____
Fault#98	76	see text	-	-	NonC	_____
Fault#99	76	see text	-	-	Crit	_____

Meters & Relays

	Parameter	Page	Range	Step	Unit	Default	User Setting
Meter Setup	Meter #1	77	see text	-	-	Asc	
	Meter #2	77	see text	-	-	Vsc	
	AutoRange	78	50.0-99.9	0.1	#	99.9	
	Meter Rsts	78	see text	-	-	None	
	Scroll Tim	78	Off,1-120	1	sec.	Off	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Standard Relays	Relay#1,K5	79	see text	-	-	RUN	
	Relay#2,K6	79	see text	-	-	UTS	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Extended Relays	Opt. #1,K1	80	see text	-	-	varies	
	Opt. #2,K2	80	see text	-	-	varies	
	Opt. #3,K3	80	see text	-	-	varies	
	Opt. #4,K4	80	see text	-	-	varies	
	Opt. #5,K5	80	see text	-	-	varies	
	Opt. #6,K6	80	see text	-	-	varies	
	Opt. #7,K7	80	see text	-	-	varies	

Event Recorder

	Parameter	Page	Range	Step	Unit	Default	User Setting
Event Recorder	Event recorder	81	last 99 events				

Control Config

	Parameter	Page	Range	Step	Unit	Default	User Setting
System Clock	Minutes	83	0-60	1	min.	0	
	Hours	83	0-23	1	hour	0	
	Day	83	1-31	1	day	1	
	Month	83	1-12	1	month	0	
	Year	83	0-99	1	year	0	

	Parameter	Page	Range	Step	Unit	Default	User Setting
System Password	Password	84	000-999	1	-	000	

9.1 PARAMETER LIST

	Parameter	Page	Range	Step	Unit	Default	User Setting
Comm. Settings	COMM. Mode	85	see text	-	-	Off	
	COM Addres	85	0-255	1	#	127	
	COM Delay	85	0.02-2.00	0.01	sec.	0.35	
	MB:Baud	86	see text	-	bps	2400	
	MB:Com T/O	86	Off,1-900	1	sec.	Off	
	DN:MAC ID	86	0-63	1	#	63	
	DN:Baud	86	see text	-	kbps	125	
	DN:InAssy	87	see text	-	#	61	
	DN:OutAssy	87	see text	-	#	100	
	DN:T/O Act	87	none,stop	-	#	none	
	DN:Rev	87	major, minor	-	-	none	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Options List	Options listed	88					

	Parameter	Page	Range	Step	Unit	Default	User Setting
Software Part#	Software Part#	89	see text				

Factory Setup

	Parameter	Page	Range	Step	Unit	Default	User Setting
Hardware Setup	C.T. Ratio	90	see text	-	#	288	
	Relay Card	90	see text	-	-	None	

	Parameter	Page	Range	Step	Unit	Default	User Setting
BIST Setup/Run	Start BIST	91	Yes,No	-	-	No	
	Test Inlin	91	Yes,No	-	-	Yes	
	Test Bypas	91	Yes,No	-	-	Yes	
	100% Gates	91	Yes,No	-	-	No	

	Parameter	Page	Range	Step	Unit	Default	User Setting
Factory Control	FACT Pass.	92	see text				

RTD Setup

	Parameter	Page	Range	Step	Unit	Default	User Setting
RTD Module Setup	Mod#1 Addr	94	16-23	1	#	16	
	Mod#2 Addr	94	16-23	1	#	17	
	#RTDs Mod1	94	None,1-8	1	#	None	
	#RTDs Mod2	94	None,1-8	1	#	None	
	Temp Scal	94	C,F	-	-	C	

	Parameter	Page	Range	Step	Unit	Default	User Setting
RTD SetPnts 1-8	RTD#1 Grp	95	see text	-	-	None	
	RTD#1 Warn	95	see text	1	temp	Off	
	RTD#1 Alm	95	see text	1	temp	Off	
	RTD#2 Grp	95	see text	-	-	None	
	RTD#2 Warn	95	see text	1	temp	Off	
	RTD#2 Alm	95	see text	1	temp	Off	
	RTD#3 Grp	95	see text	-	-	None	
	RTD#3 Warn	95	see text	1	temp	Off	
	RTD#3 Alm	95	see text	1	temp	Off	
	RTD#4 Grp	95	see text	-	-	None	
	RTD#4 Warn	95	see text	1	temp	Off	
	RTD#4 Alm	95	see text	1	temp	Off	
	RTD#5 Grp	95	see text	-	-	None	
	RTD#5 Warn	95	see text	1	temp	Off	
	RTD#5 Alm	95	see text	1	temp	Off	
	RTD#6 Grp	95	see text	-	-	None	
	RTD#6 Warn	95	see text	1	temp	Off	
	RTD#6 Alm	95	see text	1	temp	Off	
	RTD#7 Grp	95	see text	-	-	None	
	RTD#7 Warn	95	see text	1	temp	Off	
	RTD#7 Alm	95	see text	1	temp	Off	
	RTD#8 Grp	95	see text	-	-	None	
	RTD#8 Warn	95	see text	1	temp	Off	
	RTD#8 Alm	95	see text	1	temp	Off	

	Parameter	Page	Range	Step	Unit	Default	User Setting
RTD SetPnts 9-16	RTD#9 Grp	96	see text	-	-	None	
	RTD#9 Warn	96	see text	1	temp	Off	
	RTD#9 Alm	96	see text	1	temp	Off	
	RTD#10 Grp	96	see text	-	-	None	
	RTD#10Warn	96	see text	1	temp	Off	
	RTD#10 Alm	96	see text	1	temp	Off	
	RTD#11 Grp	96	see text	-	-	None	
	RTD#11Warn	96	see text	1	temp	Off	
	RTD#11 Alm	96	see text	1	temp	Off	
	RTD#12 Grp	96	see text	-	-	None	
	RTD#12Warn	96	see text	1	temp	Off	
	RTD#12 Alm	96	see text	1	temp	Off	
	RTD#13 Grp	96	see text	-	-	None	
	RTD#13Warn	96	see text	1	temp	Off	
	RTD#13 Alm	96	see text	1	temp	Off	
	RTD#14 Grp	96	see text	-	-	None	
	RTD#14Warn	96	see text	1	temp	Off	
	RTD#14 Alm	96	see text	1	temp	Off	
	RTD#15 Grp	96	see text	-	-	None	
	RTD#15Warn	96	see text	1	temp	Off	
	RTD#15 Alm	96	see text	1	temp	Off	
	RTD#16 Grp	96	see text	-	-	None	
	RTD#16Warn	96	see text	1	temp	Off	
	RTD#16 Alm	96	see text	1	temp	Off	

10. Application Glossary

10.1 APPLICATION GLOSSARY

Glossary

A

AC	Alternating Current
Ambient Temperature	Is the temperature of the air, water or a surrounding medium where equipment is operated or stored.
American Wire Gauge	A standard system used for designing the size of electrical conductors. Gauge numbers have an inverse relationship to size; larger numbers have a smaller cross-sectional area. However, a single strand conductor has a larger cross sectional area than a multi strand conductor of the same gauge so that they have the same current carrying specification.
Auto Synchronizing	Auto Synchronizing of the gate timing pulses matches each phase firing angle to their respective phases. The soft start actively tracks minor shifts in the line frequency, avoiding nuisance tripping that may happen with conventional gate firing systems.

B

Buffer	- In software terms, a register or group of register used for temporary storage of data to compensate for transmission rate differences between the transmitter and receiving device. - In hardware terms, an isolating circuit used to avoid the reaction of one circuit with another.

C

Contactor, Reversing	A method of reversing motor rotation by the use of two separate contactors, one of which produces rotation in on direction and the other produces rotation in the opposite direction. The contactors are electrically (and mechanically) interlocked so that both cannot be energized at the same time.
CPU Board	This is where the microprocessor. The CPU Board is attached to the main power, and communicates to it and the keypad operator interface via ribbon cables. The CPU determines operating functions, stores user programming and acts on feedback signals for faults, metering and historical data. This board also contains the flash EEPROM and SRAM memory.
Cursor	The intensified or blinking element in a video display. A means for indication where data entry or editing occurs.
Cycle	- A sequence of operations that is repeated regularly - The time it take for one sequence of operations to occur.

D

DeviceNet	A producer / consumer based, high speed multi-node network.
Disable	To inhibit logic from being activated.
Duty Cycle	The relationship between the operation and rest time or repeatable operation at different loads.
DV/DT	The DV/DT boards are used to reduce voltage transients across the stack assemblies.

E

Enable	To allow an action or acceptance of data by applying an appropriate signal to the appropriate input.

F

Fault	Any malfunction that interferes with normal system operation.
Fiber Optic Isolation	Is provided for all signal interfaces between the medium and low voltage systems.

G

Gate	The control element of an SCR (silicon controlled rectifier) commonly referred to as a thyristor. When a small positive voltage is applied to the gate momentarily, the SCR will conduct current (when the anode is positive with respect to the cathode of the SCR). Current conduction will continue even after the gate signal is removed.
Gate Drive Boards	Are located directly on the SCR stacks. These boards communicate to the main power board via fiber optic cables. They amplify the gate pulse signals with power from the ring transformer to create two sustained pulse firing of the SCRs. There is one gate drive board for each pair of SCRs in each stack.

H

I

Interface Board	This circuit board take line-side and load-side voltage feedback signals from the voltage feedback board and passes them via pin cables to the processor.

J

Jogging	Is a means of accomplishing momentary motor movement by repetitive closure of a circuit using a single push button or contact element.
Jumper	A short conductor with which you connect two parts.

K

Keypad	Is a 2 line x 16 character LCD display with backlighting for low ambient conditions. The display reads out in truncated english and can show multiple data points in each screen.

L

LCD	Liquid crystal display, which is a reflective visual readout device commonly used in digital watches and laptop computers.
Locked Rotor Torque	The minimum torque that a motor will develop at rest for all angular positions of the rotor with rated voltage applied at rated frequency.
Low Voltage	Low Voltage electronics include the keypad operator interface, CPU, main power PC board and are located in isolated low voltage compartments of the enclosure.

M

Main Power Board	This is also referred to as the firing board. It contains the digital I/O relays and interfaces to the terminal for user interface. See "terminal and control". It also controls the sequencing of the isolation and bypass contactors with the SCR firing. This board generates all firing signals for the SCR stacks and receives feedback signals from the fiber optic transmitters. It converts analog levels to digital signals for the CPU. These firing pulses are via fiber optic signals to isolate them from the medium voltage environment.
Medium Voltage	Control electronics are located in the medium voltage section of the soft start. The main line power must be disconnected before accessing these electronics, which include the TCB (terminal and control board), gate drive, and temp/CT(current transformer) board.
ModBUS	A registered based, multi-point network
Mode	A selected method of operation. For example; run

N

Normally Closed Contacts	A set of contacts on a relay or switch that are closed when the relay is de-energized or the switch is de-activated. They are open when the relay is energized or the switch is activated
Normally Open Contacts	A set of contacts on a relay or switch that are open when the relay is de-energized or the switch is de-activated. They are closed when the relay is energized or the switch is activated.

O

P

Port	Power outage ride-through
Power Factor	A measurement of the time phase difference between the voltage and current in an AC circuit. It is represented by the cosine of the angle of this phase difference. Power factor is the ratio of Real Power (kW) to total kVA or the ratio of actual power (W) to apparent power (volt-amperes).
Preset Speed	Refers to one or more speeds at which the drive will operate.
Programmable Controller	A solid state system that has user-programmable memory for storage of instructions to implement specific functions such as I/O control, logic, timing, counting, report generation, communication, arithmatic, and data file manipulation. A controller consists of a central processor, input/output interface, and memory. A controller is designed as an industrial control system.
Protocol	A set of conventional governing the format and timing of data between communication devices.

Q

R

Ramp	Is the charted path that the torque, current, power, follows will achieving maximum torque.
Ramp Time	Is the time it takes for the torque to go from the initial torque, current, power setting to the maximum torque, current, power setting.
Remote I/O	I/O connected to a processor across a serial link. With a serial link, remote I/O can be located long distances from the processor.
RS-232-C	An EIA standard that specifies electrical, mechanical and functional characteristics for serial binary communication circuits in a point-to-point link.
RS-422	An EIA standard that specifies electrical characteristics of balanced-voltage digital interface circuits in a point-to-point link.
RS-485	An EIA standard that specifies electrical characteristics of balanced-voltage digital interface circuits in a multi-point link.
RTD	Resistance Temperature Detector- is a temperature measurement device, used by passing a low-level current through the RTD and measuring the voltage drop.

S

Scrolling	The vertical movement of data on a display screen caused by the dropping of one line of display data for each new line added at the opposite end.
Serial	Pertaining to time sequential transmission of, storage of, or logic operations on data, using the same facilities for successive parts.
Service Factors	When used on a motor nameplate, a number which indicates how much above the nameplate rating a motor can be loaded with out causing serious degradation (i.e., a motor with 1.15 S-F can produce 15% greater torque than one with 1.0 S-F) to adjust measured loads in an attempt to compensate for conditions which are difficult to measure or define.
SCR Gate Firing Circuit	The soft start contains a firing circuit that includes several unique features that maximize performance without the need for reactors or field installed devices used in other systems, regardless of conditions. These features include; Auto Synchronizing, sustained pulse firing, closed loop firing control, transformer isolation and fiber optic isolation.
Silicon Controlled Rectifier (SCR)	A solid state switch, sometimes referred to as a thyristor. The SCR has an anode, cathode and control element called the gate. The device provides controlled rectification since it can be turned on at will. the SCR can rapidly switch large currents at high voltage.
Status	The condition at a particular time of any numerous entities within a system. These conditions may be represented by values in a status line.
Surge Protection	The process of absorbing and clipping voltage transients on an incoming AC line or control circuit. MOVs (Metal Oxide Varistors) and specially designed R-C networks are usually used to accomplish this.

Sustained Pulse Firing	Keeps the firing signal active for 270 electrical degrees, ensuring that the DC gate pulse causes the SCR to fire even if line noise is present at a critical moment. this provides noise immunity and protects against misfiring, enhancing system reliability.

T

Terminal and Control Board	This is the user connection interface board. It is located in the medium voltage section in order to satisfy UL termination requirements but does not actually connect directly to the medium voltage components other than the contactor coils. This board contains the user terminal blocks, out relays (duplicated), inputs, and control power connections. It also contain additional timed relays for interfacing with power factor correction contactors (if used) and other external devices.
Toggle	To switch alternately between two possible selections
Transformer Isolation	Prevents the interference from line noise and EMI/RFI signals that may be present. Specially designed 120 V, 3-phase isolation transformers provide potential measurement, firing board power, and gate power systems while isolated from the line voltage. High isolation ring transformers are used to reduce the voltage down to 28 Vac for the sustained pulse firing circuit, providing further isolation for the SCR gates. Additional magnetic isolation is provided via a separate control power transformer (CPT), which powers the low voltage controls and the CPU.
Transient	A momentary deviation in an electrical or mechanical system.

U

cUL	Canadian Underwriters Laboratories (an approval agency)

V
W
X
Y
Z

Notes:

11. Warranty

3-Year Warranty Data Sheet

Warranty Notes WN0001-00

3-YEAR WARRANTY DATA SHEET

Benshaw's standard warranty is one (1) year from date of shipment. Benshaw will extend this warranty to three (3) years from date of shipment when done by a supervised start up by a Benshaw Technician. See attached Warranty Statement and Terms and Conditions.

STARTER INFORMATION:

Date of Startup:	Date of purchase:
Benshaw Model #:	Benshaw Serial #:

USER INFORMATION (OWNER):

Company Name:		
Address:		
Contact:	Phone:	Fax:
Purchased from (Distributor):		

MOTOR INFORMATION:

Type of Motor: ☐ Std. Induction ☐ Wound Rotor ☐ Synchronous ☐ Other _____			
Make:		*Synchronous Motors*	*Wound rotor motors*
HP:	SF:	Field Voltage:	Secondary Volts:
VOLTS:	LRA:	Field Amps:	Secondary Amps:
FLA:	NEMA Design:	Field Resistor:	Secondary Resistance:
RPM:	Frame:		
FREQ:	KVA Code:		

LOAD INFORMATION:

Type of driven load:		
MFG. of driven equipment:	Model #:	Serial #:

POWER SYSTEM INFORMATION:

☐ Utility Power Transformer Rating _____ kVA	☐ Generator Generator Rating _____ kW
Power cable run from source to starter: _____ ft ☐ Approximate or ☐ Actual	
☐ Power Factor Caps/Surge Caps/Lightning Arrestors moved to line side of solid-state starter or removed. **DANGER:** Equipment may be damaged or personal injury may result if equipment is started with lightning arrestors, power factor capacitors or surge capacitors connected on the load side of the solid-state motor controls.	

STARTUP PROCEDURES (All procedures are found in your instruction manual):

☐ Pre-startup procedures followed	☐ Connection procedures followed	☐ Startup procedures followed
☐ Proper cable size	☐ All Connections tight (Power & Control)	
Name of person completing this report:	Signature:	

WARRANTY STATUS (For Benshaw Office Use Only):

Date Shipped:	Comments:
Effective Date:	
Expiration Date:	Approved by:

Please return to your nearest Benshaw distributer:

Benshaw Inc., 1659 E. Sutter Road, Glenshaw, PA, 15116, Attn: Warranty Department, Fax: 412-487-4201
Benshaw Canada, 550 Bright St. East, Listowel, Ontario, N4W 3W3, Attn: Warranty Department, Fax: 519-291-2595

********** Complete the warranty registration on-line at http://www.benshaw.com **********

3-YEAR WARRANTY DATA SHEET

General Conditions

All warranties are provided in accordance with Benshaw, Inc. Terms and Conditions of Sale. Benshaw warrants it's products including printed circuit boards, power electronic assemblies and integral bypass contactors per the periods and warranty types listed below. Other manufacturer's products which are included in the Benshaw equipment such as circuit breakers, fuses, transformers, relays, pilot devices and other power/control components are warranted per the terms and conditions of the manufacturer's original equipment warranty. All warranty periods for Benshaw manufactured products are based on the date of shipment unless otherwise specified.

Solid State Reduced Voltage Product		Warranty Period	Warranty Type	Warranty Registration
RSD6	Non Reversing Starter	3 Years *	Factory Repair or Exchange	Data Sheet
RDB6	Non Reversing with Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
RSM6	Non Reversing Starter	3 Years *	Factory Repair or Exchange	Data Sheet
RSM6B	Non Reversing with Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
RMB6	Non Reversing with Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
RSM7	Non Reversing / DC Brake	3 Years *	Factory Repair or Exchange	Data Sheet
RSM7B	N. Reversing / Brake / Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
RSM10	Reversing Starter	3 Years *	Factory Repair or Exchange	Data Sheet
RSM10B	Reversing / Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
RSM11	Reversing / DC Brake	3 Years *	Factory Repair or Exchange	Data Sheet
RSM11B	Reversing / Brake / Bypass	3 Years *	Factory Repair or Exchange	Data Sheet
MVRSM	Medium Voltage-All Types	3 Years	Active On Site	Startup Service
WRSM6	Wound Rotor Starter	3 Years *	Factory Repair or Exchange	Data Sheet
SMRSM6B	Synchronous Starter	3 Years *	Factory Repair or Exchange	Data Sheet
DCB3	DC Injection Brake	3 Years	Factory Repair or Exchange	Data Sheet
RS6	Non Reversing Starter	1 Year	Factory Repair or Exchange	Shipping Records / Data Sheet

* Motors larger than a T – Frame require a supervised start up for the 3-year warranty.

Factory Repair or Exchange:

Benshaw will repair or replace, at its option, all Benshaw manufactured components, which fail within the defined warranty period. Failures, which are caused by unauthorized repairs, mechanical, electrical or physical abuse and acts of God such as lightning, fires or floods, are excluded. The customer pays freight and any required labor costs.

Active On Site Time and Parts:

If Benshaw determines that on site repairs or exchange is necessary, Benshaw or an authorized service agent will perform the necessary work on site. Benshaw will provide the actual service time and required parts to repair the unit. The customer will pay for travel time and living costs to the site and any waiting time to perform the repairs. Failures, which are caused by unauthorized repairs, mechanical, electrical or physical abuse and acts of God such as lightning, fires or floods, are excluded. A purchase order must be issued for the non-warranty travel and living costs prior to the work being performed.

Warranty Registration – Installation Data Sheet:

For low voltage products, the Benshaw warranty registration form must be completed and returned to Benshaw within five (5) days of startup to activate the 3-year warranty. If the data sheet is not completed and returned, the warranty will be 12 months from date of shipment. All recommended maintenance procedures must be followed throughout the warranty period. Motors larger than a T-Frame require a Benshaw authorized representative to start the equipment to activate the 3-year warranty.

Warranty Registration – Benshaw Startup Service:

For Medium Voltage products, Benshaw or an authorized service agent must startup the equipment and complete the installation data sheet to activate the 3-year warranty from date of shipment. If the data sheet is not completed and returned, the warranty will be 12 months from date of shipment. The cost of this service is not included in the price of the Benshaw equipment and will be quoted separately to the customer. All recommended maintenance procedures must be followed throughout the warranty period.

12/18 Month Warranty

These warranties are 12 months from date of startup or 18 months from date of shipment, whichever is sooner.

NOTES:

Revision History;

Revision	Date	ECO#
07	8/14/01	0064, 0131
08	10/01/01	E0189
09	23/02/06	E759

Software Versions Covered by this Document;

MVRSM12/18 Series

- 810010-02-xx - MV standard soft-starter.

BENSHAW PRODUCTS

Low Voltage Solid State Reduced Voltage Starters

- RSD/RSM6 - SSRV Non or Separate Bypass
- RDB/RMB6 - SSRV Integral Bypass
- RSM7 - SSRV + DC Injection Braking
- RSM10 - SSRV + Reversing
- RSM11 - SSRV + DC Injection Braking + Reversing
- RSM10/12TS - SSRV Two Speed
- WRSM6 - SSRV Wound Rotor
- SMRSM6 - SSRV Synchronous
- DCB3 - Solid State DC Injection Braking

Medium Voltage Solid State Reduced Voltage Starters

- 5kV - Induction or Synchronous to 10,000HP
- 7.2kV - Induction or Synchronous to 10,000HP
- 15kV - Induction or Synchronous to 60,000HP

Low Voltage - AC Drives

- Standard Drives to 1000HP
- Custom Industrial Packaged Drives
- HVAC Packaged Drives
- 18 Pulse/IEEE 519 Compliant Drives

RSC Series Contactors

- SPO/SPE/SPD Motor Protection Relays
- Enclosed Full Voltage, Wye Delta, Two Speed Part Winding and Reversing Starters

Custom OEM Controls

Sales and Service

United States
Pittsburgh, Pennsylvania
Indianapolis, Indiana
Syracuse, New York
Boston, Massachusetts
Charlotte, North Carolina
Birmingham, Alabama
Los Angeles, California
Detroit, Michigan
Milwaukee, Wisconsin
Phoenix, Arizona
Seattle, Washington
Denver, Colorado
Houston, Texas
Minneapolis, Minnesota
Newark, New Jersey

Canada
Listowel, Ontario
Toronto, Ontario
Montreal, Quebec
Calgary, Alberta

South America
Sao Paulo, Brazil
Santiago, Chile
Lima, Peru
Bogota, Columbia
Buenos Aires, Argentina
Santa Cruz, Bolivia
Guayaquil, Ecuador

Mexico
Shanghai
Australia
Singapore

BENSHAW Inc.
1659 East Sutter Road
Glenshaw, PA 15116
Phone: (412) 487-8235
Fax: (412) 487-4201

BENSHAW West
14715 North 78th Way
Suite 600
Scottsdale, AZ 85260
Phone: (480) 905-0601
Fax: (480) 905-0757

BENSHAW High Point
EPC Division
645 McWay Drive
High Point, NC 27263
Phone: (336) 434-4445
Fax: (336) 434-9682

BENSHAW Mobile
CSD Division
5821 Rangeline Road Suite 202
Theodor, AL 36582
Phone: (251) 443-5911
Fax: (251) 443-5966

BENSHAW Pueblo
Trane Division
1 Jetway Court
Pueblo, CO 81001
Phone: (719) 948-1405
Fax: (719) 948-1445

Ben-Tech Industrial Automation
2904 Bond Street
Rochester Hills, MI 48309
Phone: (248) 299-7700
Fax: (248) 299-7702

BENSHAW Canada
550 Bright Street
Listowel, Ontario N4W 3W3
Phone: (519) 291-5112
Fax: (519) 291-2595