

Model S3460BR
Battery Regulator Ride-Thru Cabinet System

Customer Reference Manual

Bonitron, Inc.



An Industry Leader in AC Drive Systems and Industrial Electronics

OUR COMPANY

Bonitron Inc. is an industrial electronics and electrical systems design, engineering, and manufacturing company founded in 1962 and located in Nashville, Tennessee. Bonitron designs and manufactures custom and standard product modules and systems for industry with the highest possible degree of quality and reliability.

Bonitron has all the necessary resources in-house for complete electronic product development and manufacturing. Engineering facilities include a CAD lab for circuit board design and engineering labs for prototype testing and evaluation. Production facilities include production areas for circuit board assembly, a machine tool and sheet metal shop for chassis fabrication, and a systems assembly and checkout area. With these assets, Bonitron is positioned to be a leader into the future while maintaining first class support for their current customer base.

Worldwide sales of equipment are generated mainly by reputation and referrals. Our customer base includes all of the major drive manufacturers, their distributors, OEMs, end users, and many other satisfied companies. Equipment is installed throughout the United States as well as in Canada, Mexico, Costa Rica, Argentina, Brazil, Chile, Venezuela, Northern Ireland, the Netherlands, Spain, Hungary, Israel, Turkey, China, India, Indonesia, Singapore, Taiwan, and the Philippines.

TALENTED PEOPLE MAKING GREAT PRODUCTS

The engineering team at Bonitron has the background and expertise needed to design, develop, and manufacture the quality industrial systems demanded by today's client. A strong academic background supported by continuing education is complemented by many years of hands-on field experience. Expertise encompasses a broad range of applications and engineering solutions such as modern power conversion design techniques and microprocessor-based controls. This insures a solution tailored to the specific needs of the client.

A clear advantage that Bonitron has over many competitors is combined on-site engineering labs and manufacturing facilities. This allows the engineering team to have immediate access to and response from testing and manufacturing. This not only saves time during prototype development, but also is essential to providing only the best quality products.

AC DRIVE OPTIONS

In 1975, Bonitron began working with the AC inverter drive specialists at synthetic fiber plants to develop speed control systems that could be interfaced to their plant process computers. Since that time, Bonitron has developed AC drive option modules that help overcome many of the problems encountered in applications of modern AC variable frequency drives. Bonitron's Ride-Thru module provides protection from AC line voltage sags while the Line Regen and Resistive Braking modules provide DC Bus regulation for over-voltage due to regenerated voltage. Today, many drive system integrators use Bonitron AC drive option modules with their variable frequency drives.

WORLD CLASS PRODUCTS

Bonitron has developed over 3000 different modules and systems. Bonitron is willing and able to meet the unique specifications the client may request.

Some Bonitron products include:

- Power Sag Ride-Thru Modules
- Power Outage Ride-Thru Modules
- Line Regen Modules
- Resistive Braking Modules
- Modular High Speed Precision AC Inverter Systems
- Inverter Upgrade Modules
- Multi-motor, Multi-phase Current Sensors
- Battery Production Charging Systems
- Data Acquisition Systems
- Process Controllers
- Temperature Control Systems
- RMS True Reading Digital Voltmeters, Ammeters, and Frequency Meters

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1. INTRODUCTION

1.1. WHO SHOULD USE

This manual is intended for use by anyone who is responsible for integrating, installing, maintaining, troubleshooting, or using this equipment.

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual describes a 4- or 15-Minute Battery Regulator Ride-Thru System, with single or dual DC bus outputs, used to regulate a battery bank, which provides DC bus power for AC PWM inverter drives during a power sag or loss situation.

In the event of any conflict between this document and any publication and/or documentation related to the AC drive system, the latter shall have precedence.

1.3. MANUAL VERSION AND CHANGE RECORD

Rev 01a contains additional data in Section and clarifications 7.

Figure 1-1: S3460BR Booster Cabinet



Figure 1-2: Battery Cabinet

(sold separately)



2. PRODUCT DESCRIPTION

Bonitron S3460BR series of DC Bus Ride-Thru systems provide protection from long term line voltage outages for Variable Frequency Drives (VFDs) that use a fixed rectifier and DC bus. Providing power for outage times up to 15 minutes allows sufficient time for 3 generator start ups and transfer to auxiliary power.

Industries with continuous processes can suffer huge losses from equipment downtime, loss of production, or damaged product when VFDs trip on under-voltage conditions. While many drives claim to have ride thru capability such as auto restart or kinetic buffering, none are able to control the motor during a complete loss of power.

Typical UPS solutions are designed to increase drive availability, but are connected in series which decreases overall drive system reliability. All Bonitron Ride Thru products connect in parallel with the drive, thus increasing system availability and reliability.

Bonitron Power Source S3460BR systems provide sufficient ride through capability to handle these outages by storing energy in battery banks and releasing it back into the drives DC bus when needed. The internal M3460B boost module regulates the dropping battery voltage up to the drives desired DC bus level. This allows the drive to “ride through” these events while, MAINTAINING MOTOR SPEED and TORQUE, without experiencing drive shutdown.

A complete S3460BR battery back up system includes charger, isolation transformer, and booster. Batteries are sold separately. Standard systems and custom packages are available.

S3460BR is Bonitron’s most cost effective product to ride through long term outages with drive systems ranging from 62 to 1350kW.

ADVANTAGES

1. Reliability
 - Connects parallel to existing system
 - Ride-Thru failure does not affect normal process
 - Ride-Thru maintenance can be done while normal process is on-line
 - Open battery bypass option available
 - Open battery detection option available
 - AC input option available
2. Redundancy
 - Battery bypass option means one bad battery does not spoil the bunch
 - Some Ride -Thru modules use multiple stages
 - Single stage failure only means reduced capability
3. Additional AC input option voltage sag protection
 - Increases battery life by using energy from AC line for small voltage sags
 - Allows sag protection during battery maintenance
4. Easy retrofit installation
 - Works with most any fixed bus PWM drive
 - Only 2 parallel connections to existing system for DC battery regulator
 - Only 3 parallel connections for AC option
 - Can use existing AC feed wiring
 - Can use existing AC feed breakers
5. Installed Cost
 - \$300 to \$500 per kW
 - Less expensive than other options:
 - Traditional UPS

- Flywheel technology
- Capacitive energy storage
- 6. Easy testing
 - Can test system on-line or off-line
 - Can take off-line for repair or testing without disrupting the process
- 7. Instant response
 - No "switchover time"
 - Maintains control of motor speed and torque
- 8. Easy commissioning
 - No programming
 - Can power up/down with system on-line
 - Single fine tune level adjustment
- 9. No RF interference
 - Slow switching speeds internally filtered
 - Feeds DC to inverter bus
- 10. Control room communications
 - Single fault contact
 - Detailed I/O signals
- 11. System monitoring
 - LEDs
 - Voltage and current
 - Activity counter
- 12. Custom options available
 - Ability to adapt for custom configurations

2.1. RELATED DOCUMENTS AND PRODUCTS

M3528D OPEN CELL BYPASS

For a failsafe battery system, the RTM allows bypassing an open battery cell while under load. A typical series battery string is only as good as the worst battery. When any battery gets weak or opens the whole string is ruined. If Bonitron's Open Battery Bypass Option is used and a battery opens during discharge, the Battery Monitor will show which battery is open, and the diode will automatically bypass that battery. The RTM will make up the lost voltage and maintain the drive bus at threshold. Batteries can now be replaced on a one by one basis. See Figure 7-1.

ASB 3528M1 BATTERY MONITOR BOARD:

The ASB 3528M1 Board monitors up to 6 batteries within the battery bank and will alert the user of any voltage above or below the respective setpoints. Therefore if one of the batteries within the bank is faulty the user will be able to pinpoint and replace the defective cell.

ASB 3528M2 BATTERY BANK MONITOR BOARD:

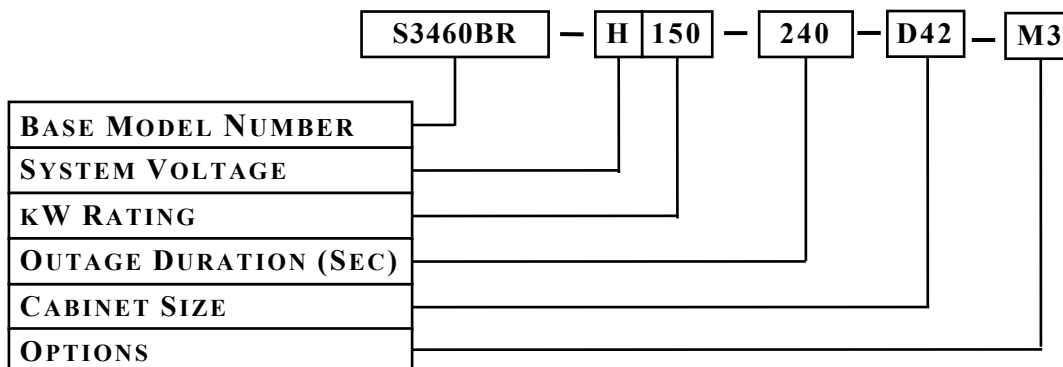
The ASB 3528M2 board monitors DC levels and changes the relay states if voltage drops below or rises above preset levels. This can be used to stop overcharging or discharging of batteries to increase life.

ASB 3528M4 BATTERY MONITOR BOARD:

The ASB 3528M4 Board monitors up to 10 batteries within the battery bank and will alert the user of any voltage above or below the respective setpoints. Therefore if one of the batteries within the bank is faulty the user will be able to pinpoint and replace the defective cell.

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for all Battery Regulator Ride-Thru Cabinet Systems is **S3460BR**.

SYSTEM VOLTAGE RATING

The Model S3460BR Ride-Thru is available in several system voltages. The rating is indicated by a numerical code as shown in Table 2-1.

Table 2-1: System Voltage Rating Codes

RATING CODE	VOLTAGES (NOMINAL AC LINE / DC BUS)
U	115VAC Line / 160VDC
L	230VAC Line / 320VDC
E	400VAC Line / 565VDC
H	460VAC Line / 640VDC
C	575VAC Line / 805VDC

CABINET SIZE:

The Model S3460BR Battery Regulator Ride-Thru is available in various cabinet sizes. Size is dependent on the boost module’s kW rating.

The cabinet size is indicated by a code as shown in Table 2-2.

Table 2-2: Cabinet Codes

CABINET CODE	DIMENSIONS	SYSTEM KW RATING (4 MINUTE)	SYSTEM KW RATING (15 MINUTE)
D40	72" x 28" x 18"	22 – 62kW	----
D41	72" x 34" x 18"	65 – 100kW	22 – 62kW
D42	72" x 40" x 18"	130 – 200kW	65 – 100kW
D51	72" x 66" x 18"	234 – 360kW	130 – 200kW
D52	72" x 78" x 18"	351 – 540kW	234 – 360kW

See battery cabinet manufacturer for battery cabinet sizes.

OUTAGE DURATION:

The Outage Duration indicates the amount of time (in seconds) the M3460B module is able to hold the DC bus at the threshold level while loaded to the rated current.

This duration is directly represented by a 3-digit value. For example, 240 in this position represents 240 seconds (4 minutes) of Outage Duration.

OPTIONS:

Option Codes are separated by a comma, and are omitted when not required. Contact Bonitron if other special options are required.

Table 2-3: Option Codes

OPTION CODE	DESCRIPTION
M4	Individual Battery Voltage Monitoring
D	Dual Diode Output
K	Kinetic Buffering
DD2	Digital Display

2.3. GENERAL SPECIFICATIONS

Table 2-4: General Specifications Table

PARAMETER	SPECIFICATION
System AC Voltage	Table 2-5
Battery Bank Voltage Range	Table 7-1
Output DC Voltage	Table 2-5
DC Bus Current Rating (Max)	Tables 6-1 and 6-2
Power Rating (Max)	Tables 6-1 and 6-2
Inactive Power Consumption	Section 6.2
Ride-Thru Requirement	100% loss Duration: 4 minutes standard
Boost Circuit Configuration	Table 6-3
DC Bus Threshold	Table 2-5
Low Bus Fault Setpoint	Table 2-5
DC Bus Output Fusing	Table 6-3
DC Boost Circuit Fusing	Table 6-3
Packaging	Table 2-2
Operating temperature (Max)	40°C
Status Output Signals	Opto FET 350V, 120mA

Table 2-5: Voltage Specifications Table

AC INPUT VOLTAGE	TOLERANCE	OUTPUT DC BUS NOMINAL VOLTAGE	THRESHOLD VOLTAGE (VDC)	LOW DC BUS VOLTAGE FAULT
208	+/- 10%	290	265 (adjustable from 220-300)	230
230	+/- 10%	320	285 (adjustable from 220-300)	250
380	+/- 10%	530	485 (adjustable from 440-540)	450
400	+/- 10%	560	495 (adjustable from 440-540)	460
415	+/- 10%	580	500 (adjustable from 440-540)	465
460	+/- 10%	640	585 (adjustable from 525-625)	550
575	+/- 10%	805	710 (adjustable from 650-750)	675

2.4. PRECAUTIONS AND SAFETY WARNINGS

2.4.1. VRLA WARNINGS AND PRECAUTIONS

The following warnings and precautions are re-printed from the battery manufacturer for your convenience.

Before using the stationary value regulated lead acid battery (called "the VRLA battery" hereafter), make sure you read its accompanying user's manual or precautionary notes carefully. Since VRLA batteries store energy, inappropriate usage can cause fluid leakage, heat generation, explosion, or bodily injury. If you do not fully understand our storage battery user manual or precautionary notes, please direct your questions to Bonitron.



- **VRLA BATTERIES MAY EMIT HYDROGEN GAS. ISOLATE BATTERIES FROM FIRE, SPARKS OR OTHER IGNITION SOURCES.**
- **STORE CHARGE AND OPERATE BATTERIES ONLY IN A WELL VENTILATED AREA OR ENCLOSURE. FAILURE TO DO SO CAN LEAD TO EXPLOSION, FIRE, EQUIPMENT DAMAGE AND BODILY INJURY.**
- **DO NOT SHORT THE POSITIVE TERMINAL AND NEGATIVE TERMINAL OF THE VRLA BATTERY WITH A WIRE OR OTHER METALS. IN ADDITION, MAKE SURE METAL TOOLS, SUCH AS SCREW DRIVERS, SPANNERS, TORQUE WRENCHES ARE PROPERLY INSULATED WITH VINYL MATERIALS BEFORE USING THEM WITH ONE OF OUR VRLA BATTERIES. SHORT CIRCUITING THE TERMINALS OF THE BATTERY CAN CAUSE BURN INJURIES, DAMAGE TO THE BATTERY, OR TRIGGER EXPLOSIONS.**
- **NEVER USE THE VRLA BATTERY WITH OTHER TYPES OF BATTERIES, SUCH AS ALKALINE, NiCAD OR NiMH BATTERIES.**
- **NEVER HEAVILY HIT OR IMPROPERLY CARRY THE BATTERY.**
- **NEVER SHORT THE TERMINALS.**
- **NEVER DISASSEMBLE THE BATTERY.**



- **BATTERIES CONTAIN SULFURIC ACID. IN CASE OF A RUPTURE OR LEAKAGE, FOLLOW THESE FIRST AID INSTRUCTIONS:**
 - **INHALATION: REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN IMMEDIATELY.**
 - **INGESTION: DO NOT INDUCE VOMITING. GIVE LARGE QUANTITIES OF WATER. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. CALL A PHYSICIAN IMMEDIATELY.**
 - **SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE REUSE. EXCESS ACID ON SKIN CAN BE NEUTRALIZED WITH A 2% SOLUTION OF BICARBONATE OF SODA. CALL A PHYSICIAN IMMEDIATELY.**
 - **EYE CONTACT: IMMEDIATELY FLUSH EYES WITH GENTLE BUT LARGE STREAM OF WATER FOR AT LEAST 15 MINUTES, LIFTING LOWER AND UPPER EYELIDS OCCASIONALLY. CALL A PHYSICIAN IMMEDIATELY.**



- **WHEN CHARGING THE VRLA BATTERY, USE A DEDICATED CHARGER AND FOLLOW OUR COMPANY'S CHARGING CONDITIONS. CHARGING UNDER DIFFERENT CONDITIONS CAN CAUSE THE BATTERY TO LEAK FLUID, OVERHEAT, OR EXPLODE.**
- **DO NOT IMMERSE OR USE THE VRLA BATTERY IN WET CONDITIONS. DOING SO CAN CAUSE THE BATTERY'S TERMINALS TO CORRODE, AND/OR CAUSE ELECTRICAL SHOCK OR FIRE.**
- **USE PROPER PROTECTION, SUCH AS VOLTAGE RATED LINEMAN'S GLOVES WHEN CONNECTING THE VRLA BATTERY IN A SERIES OF 45 VOLTS OR GREATER.**
- **MAKE SURE YOU CONNECT VRLA BATTERIES BY THEIR PROPER POLARITY. CONNECTING THE BATTERY IN THE WRONG POLARITY CAN CAUSE FIRE OR DAMAGE TO THE CHARGER.**
- **DO NOT INCINERATE OR DO NOT APPLY HEAT TO THE BATTERY. VRLA BATTERIES MAY BURST OR EXPLODE WHEN BURNED.**
- **DO NOT DISASSEMBLE, MODIFY OR DESTROY THE BATTERY. DOING SO CAN CAUSE FLUID LEAKAGE, HEAT GENERATION OR EXPLOSION.**
- **BEFORE CLEANING OR CHECKING THE VRLA BATTERY, MAKE SURE YOU RELEASE YOUR BODY'S STATIC ELECTRICITY BY TOUCHING A GROUNDED METAL OBJECT. DO NOT USE A DRY CLOTH OR DUSTER TO CLEAN THE STORAGE BATTERY. ALWAYS USE A CLOTH THAT CONTAINS AN ADEQUATE AMOUNT OF MOISTURE. SPARKS CREATED BY STATIC ELECTRICITY CAN CAUSE THE STORAGE BATTERY TO TRIGGER AN EXPLOSION.**
- **REPLACE THE VRLA BATTERY AT OR BEFORE THE TIME INDICATED IN THE USER'S MANUAL OR ON THE BATTERY. USAGE BEYOND THE REQUIRED TIME OF SERVICE CAN CAUSE FLUID LEAKAGE DUE TO DAMAGES TO THE CONTAINER, OR CAUSE FIRE DUE TO POWER LEAKAGE.**



- **THE PERFORMANCE OF THE VRLA BATTERY MAY NOT BE COMPATIBLE WITH CERTAIN EQUIPMENT. CONSULT WITH BONITRON IF THE SPECIFICATIONS ARE NOT WITHIN THE TOLERANCES LISTED IN THIS MANUAL.**
- **DO NOT USE THE BATTERY IF THERE IS ANY CORROSION, CRACKING, DEFORMATION, HEAT GENERATION, OR OTHER DEFECT. PLEASE CALL THE LOCATION WHERE IT WAS PURCHASED. USING THE BATTERY WITH A DEFECT CAN CAUSE THE BATTERY TO LEAK FLUID, GENERATE HEAT OR EXPLODE.**
- **STORE ALL BATTERIES BEYOND THE REACH OF CHILDREN. ALSO KEEP CHILDREN AND INFANTS AWAY WHEN CHARGING A VRLA STORAGE BATTERY.**
- **THE TEMPERATURE RANGES FOR USING VRLA BATTERIES ARE LISTED BELOW. USAGE OUTSIDE THE FOLLOWING TEMPERATURE RANGES CAN SHORTEN BATTERY LIFE, LOWER ITS PERFORMANCE LEVEL, CAUSE THE BATTERY TO LEAK FLUID, GET DAMAGED OR DEFORMED.**
 - **DISCHARGE: -20°C TO 50°C (DURING USE OF EQUIPMENT)**
 - **CHARGE: 0°C TO 40°C**
 - **STORAGE: -20°C TO 40°C**
- **DO NOT USE OR STORE VRLA BATTERY WHERE THE SURROUNDING TEMPERATURES EXCEED 50°C. DOING SO CAN SHORTEN BATTERY LIFE, LOWER ITS PERFORMANCE LEVEL, CAUSE THE BATTERY TO LEAK FLUID, GET DAMAGED OR DEFORMED.**
- **DO NOT LET THE VRLA BATTERY'S DISCHARGE CURRENT EXCEED THE MAXIMUM VALUE FOR THE DISCHARGE CURRENT LISTED IN ITS SPECIFICATIONS. EXCEEDING THE MAXIMUM VALUE FOR THE DISCHARGE CURRENT CAN CAUSE THE BATTERY TO LEAK FLUID, OVERHEAT OR EXPLODE.**
- **MAKE SURE YOU ALWAYS TURN OFF THE SWITCHES OR THE EQUIPMENT AFTER USE. ALSO MAKE SURE THE BATTERY IS REMOVED FROM THE EQUIPMENT WHENEVER THE EQUIPMENT IS GOING TO BE OUT OF USE FOR A PROLONGED PERIOD. EXCESS DISCHARGE OF THE BATTERY CAN LOWER ITS PERFORMANCE LEVEL, SHORTEN BATTERY LIFE OR OTHER DAMAGE.**

- **AFTER USING THE BATTERY (I.E., DISCHARGING), RECHARGE AS SOON AS POSSIBLE.**
- **WHEN THE BATTERY IS NOT TO BE USED FOR A LONG PERIOD, REMOVE THE INTERNAL FUSE AND STORE IN A COOL DRY PLACE.**

2.4.2. MODEL S3460BR WARNINGS AND PRECAUTIONS



- **HIGH VOLTAGES ARE PRESENT! VOLTAGES DO NOT DRAIN ONCE POWER IS REMOVED!**
- **USE INSULATED SAFETY GLOVES AND STAND ON AN INSULATED SURFACE WHEN HANDLING BATTERY BANKS.**
- **NEVER ATTEMPT TO OPERATE THIS PRODUCT WITH THE ENCLOSURE COVER REMOVED.**
- **NEVER ATTEMPT TO SERVICE THIS PRODUCT WITHOUT FIRST DISCONNECTING POWER TO AND FROM THE UNIT.**
- **FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.**



- **CERTAIN COMPONENTS WITHIN THIS PRODUCT MAY GENERATE HIGH TEMPERATURES DURING OPERATION.**
- **ALWAYS ALLOW AMPLE TIME FOR THE UNIT TO COOL BEFORE ATTEMPTING SERVICE ON THIS PRODUCT.**
- **BEFORE ATTEMPTING INSTALLATION OR REMOVAL OF THIS PRODUCT, BE SURE TO REVIEW ALL AC DRIVE DOCUMENTATION FOR PERTINENT SAFETY PRECAUTIONS.**
- **INSTALLATION AND/OR REMOVAL OF THIS PRODUCT SHOULD ONLY BE ACCOMPLISHED BY A QUALIFIED ELECTRICIAN IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE OR EQUIVALENT REGULATIONS.**

ANY QUESTIONS AS TO APPLICATION, INSTALLATION, OR SERVICE SAFETY SHOULD BE DIRECTED TO THE EQUIPMENT SUPPLIER.

2.5. INTEGRATION RECOMMENDATIONS FOR BATTERY POWER SOURCE RIDE-THRU SYSTEMS

1. Airflow must be supplied to the Cabinet housing the booster and charger modules to remove heat during outage and recharge time, and can use thermal temp switch, RTA signal, or power loss to initiate cooling. Standby power losses are less than 300W for booster and charger and transformer. Cooling should continue 12 hours after active cycle starts.
2. The run command should be sent through the input under-voltage and over-temp contacts on the Bonitron 3460M6 interface board, so that in either case the system will shutdown, preventing damage to the booster or battery bank. Some end users purposely choose to ignore these warnings because the process is the paramount concern.
3. VFD ground fault circuits should be checked. Some VFDs have very sensitive ground faults, and when using external DC input they can be tripped. Be sure it can be disabled if a problem should occur, and be ready to add a ground fault detection somewhere upstream of the drive if that safety aspect is essential to the application.

3. INSTALLATION INSTRUCTIONS

See Section 7.2 for special considerations before installation.

3.1. ENVIRONMENT

Excessive heat within and around the Model S3460BR Battery Regulator Ride-Thru Cabinet may cause OVER-TEMP fault tripping. To prevent excess build up of heat, the max ambient temperature within the installation site should not exceed 40°C.

The Battery Regulator Ride-Thru Cabinet is provided with internal cooling fans and filters.

The Ride-Thru should be protected from corrosive environment.

3.2. PRODUCT INSPECTION / UNPACKING

Upon receipt of this product, please verify that the product received matches the product that was ordered and that there is no obvious physical damage to the unit. If the wrong product was received or the product is damaged in any way, please contact the supplier from which the product was purchased.

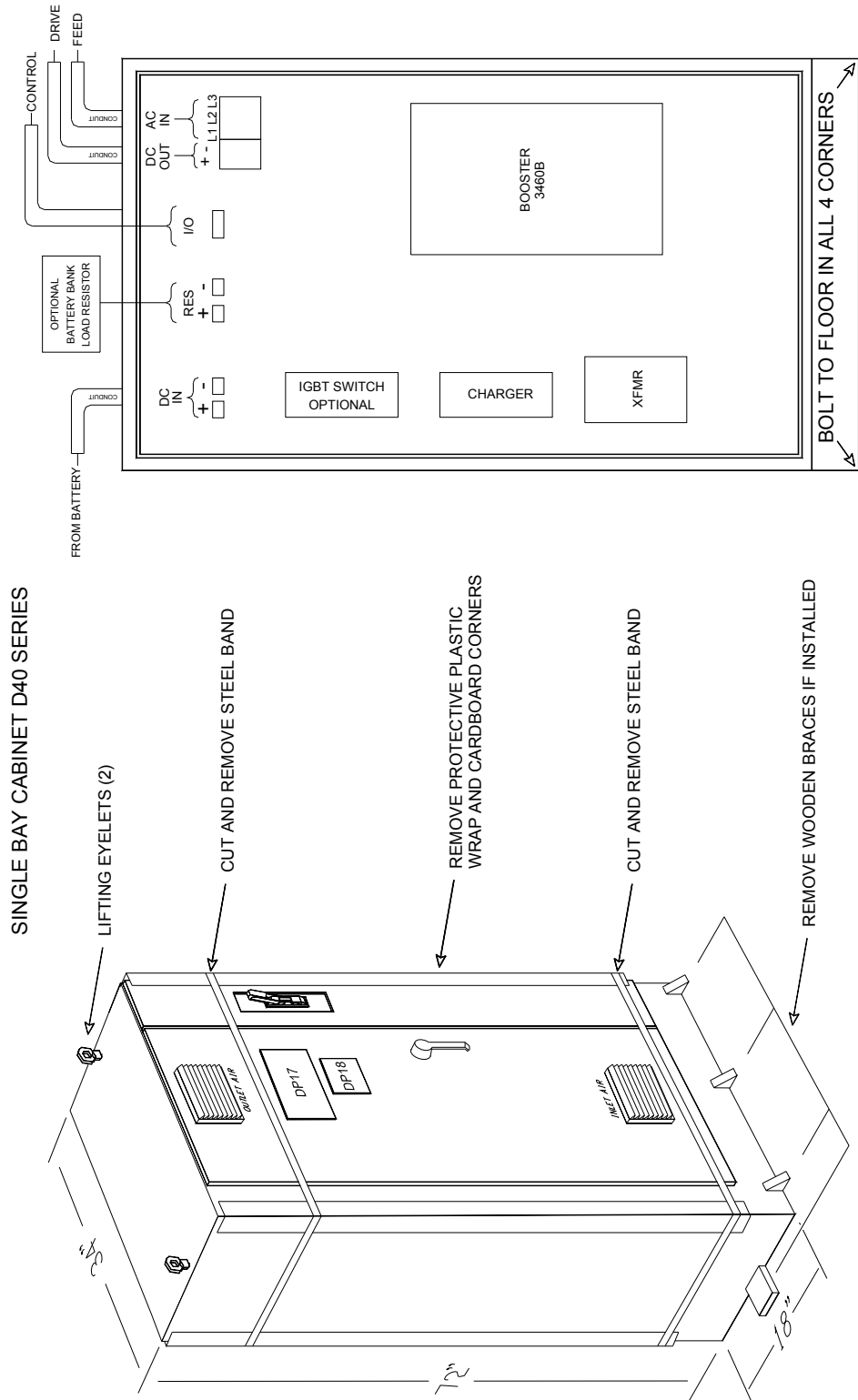
3.3. MOUNTING

Once the installation site has been selected as outlined above, the unit should be mounted in place. The cabinet is provided with eye hooks for lifting. Required mounting hardware is not supplied with the cabinet.

Cabinets can be bolted to the floor from inside, or by using angle brackets on the outside.

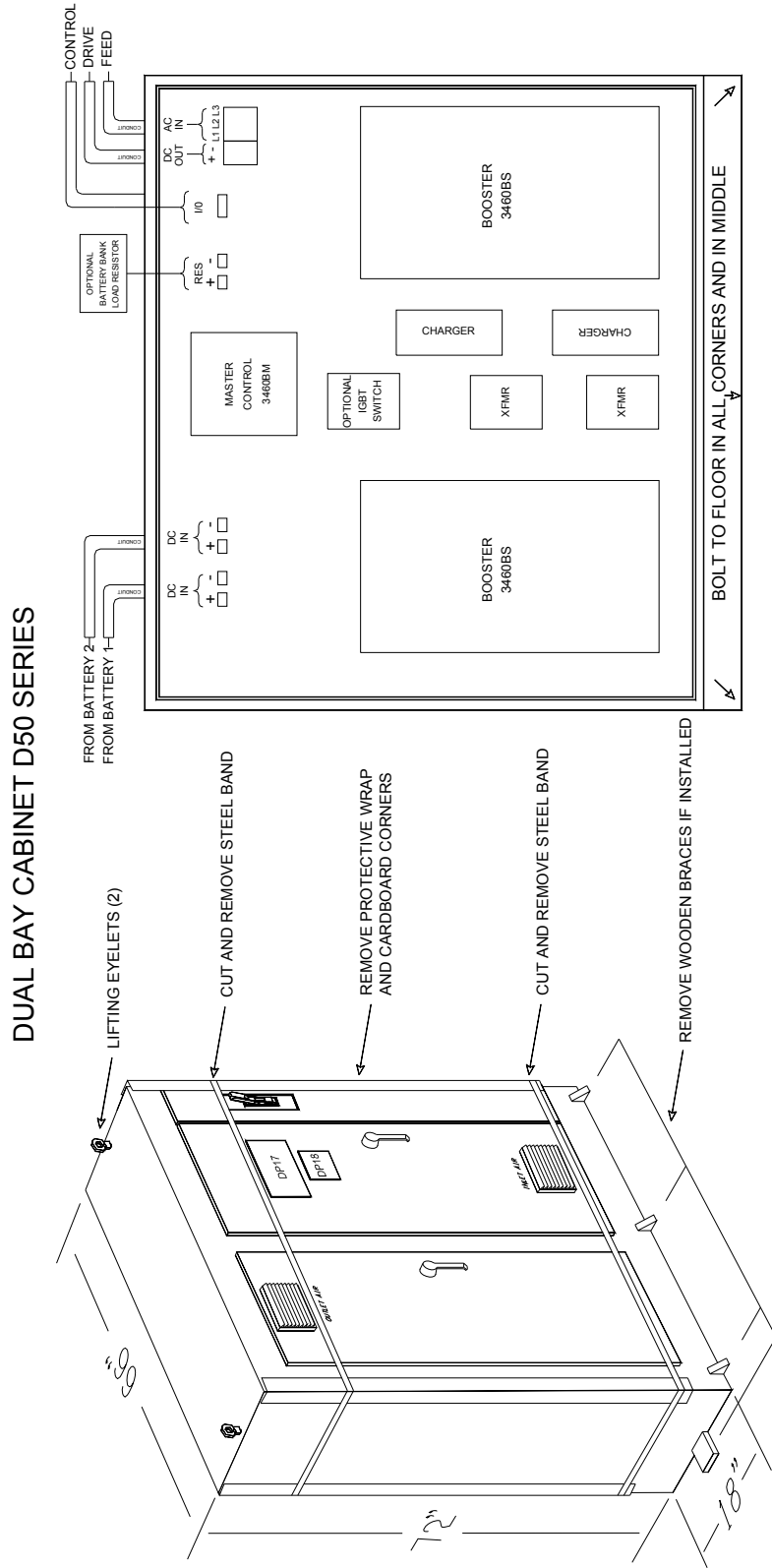
To determine the correct provisions for the unit being mounted, please refer to Figure 3-1 for a single door cabinet or Figure 3-2 for dual door cabinet. Dimensional drawings can be found in Section 6.5.

Figure 3-1: Mounting Instructions for D4* Series Cabinets



CAUTION: CABINETS CAN BE TOP HEAVY WITH DOORS OPEN SHOWN: 75KW (15 MIN. BOOSTER) CABINET (D42)

Figure 3-2: Mounting Instructions for D5* Series Cabinets



CAUTION: CABINETS CAN BE TOP HEAVY WITH DOORS OPEN SHOWN: 180KW (15 MIN. BOOSTER) CABINET (D51)

3.4. WIRING AND CUSTOMER CONNECTIONS

Review this entire Section before attempting to wire the Ride-Thru module.

3.4.1. POWER WIRING



High voltages supplied to the Battery Regulator Ride-Thru include AC line feed, the input DC battery power and output DC bus. These voltages are derived from different sources. Each source must be separately disconnected and verified zero potential before servicing. Additionally, the Ride-Thru internal DC bus retains a hazardous voltage for several minutes after the input power has been disconnected. Wait at least five minutes after disconnecting power to allow the DC bus to discharge, and then verify zero potential before servicing. Failure to observe these precautions could result in severe bodily injury or loss of life.

This section provides information pertaining to the field wiring connections of the S3460BR Ride-Thru Cabinet System. Actual connection points and terminal numbers of the AC Drive system will be found in the documentation provided with that system.

Be sure to review all pertinent AC Drive System documentation as well as the RTM to Drive Interconnection details listed below before proceeding.

3.4.1.1. SYSTEM WIRING - RTM TO DRIVE INTERCONNECTIONS

Several illustrations are provided to assist with the field connection of the 3460 Ride-Thru System to an existing AC drive system. Also, be sure to refer to the documentation supplied with the drive system for field connection points within that system. The DC bus must always be directly connected to the drive output cap bank. Connecting upstream of the DC bus inductors may damage both the drive and the Ride-Thru unit.

A typical field connection terminal layout for the S3460BR Cabinet System is shown in Figures 3-1 and 3-2. Additional drawings can be found in Section 6 of this manual.



Interconnect wiring of this product should only be performed by a qualified electrician in accordance with National Electrical Code or local codes and regulations.

3.4.1.2. TERMINAL LAYOUT

3.4.1.2.1. POWER CONNECTIONS

GROUND

Make ground connection to ground stud located at top of cabinet.

AC LINE INPUT CONNECTIONS

Make AC line feed connections to main disconnect switch at upper right side of cabinet. (See Figures 3-1, 3-2, and 3-3)

DC BUS OUTPUT CONNECTIONS

Make drive DC bus connections to main disconnect switch at upper right side of cabinet. (See Figures 3-1, 3-2, and 3-3)

DC BUS INPUT CONNECTIONS

Make battery bus connections to terminals at upper left side of cabinet. (See Figures 3-1 and 3-2)

Figure 3-3: Field Connections at Main Disconnect Switch

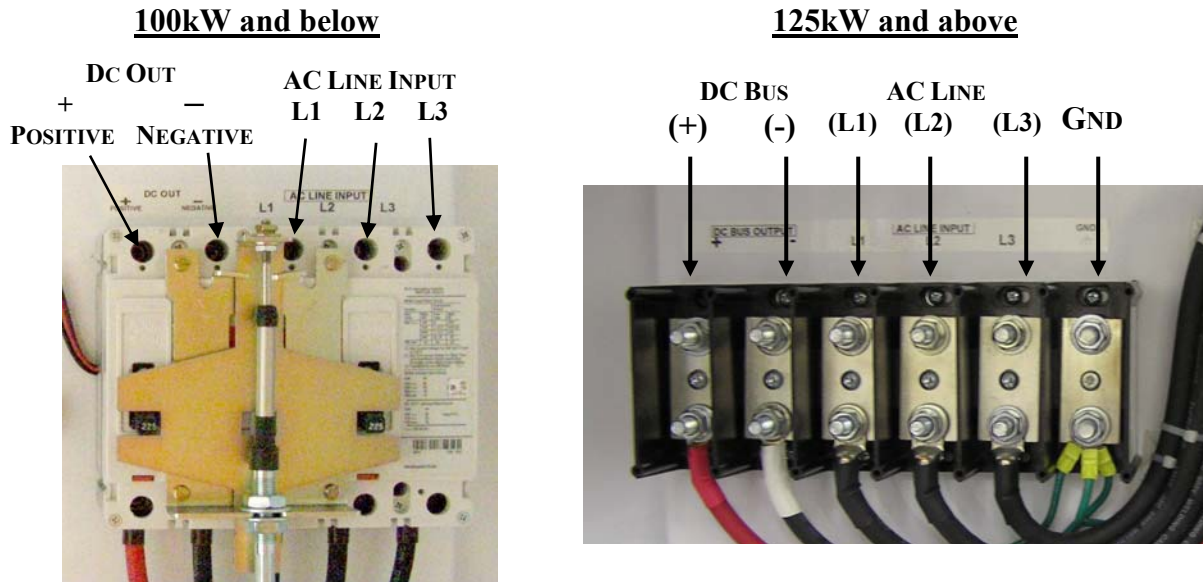


Table 3-1: Power Field Wiring Connections for Cabinets

TERMINAL TYPE	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN	POWER RATINGS
Disconnect Switch	AC Input L1, L2, L3	600VAC / 225 Amps	10	3 / 0	150 lb-in	100kW and below
Disconnect Switch	DC Output + -	600VAC / 225 Amps	10	3 / 0	150 lb-in	
Terminal Block	AC Input L1, L2, L3	600VAC / 400 Amps	3/8" Ring Lug		150 lb-in	125kW and above
Terminal Block	DC Output + -	600VAC / 400 Amps				
Stud (Ring Lug)	Gnd		18	2	45 lb-in	All units
ST38 Terminal (Ring Lug)	DC Input + -	1000VDC / 600 Amps	3/8" Ring Lug		150 lb-in	

Table 3-2: Power Field Wiring Connections for Open Backplates

TERMINAL TYPE	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
ST38 Terminal (Ring Lug)	AC Input L1, L2, L3	1000V / 600 Amps	Limited by Ring Lug	4	150 lb-in
ST38 Terminal (Ring Lug)	DC Output + -	1000V / 600 Amps	Limited by Ring Lug	4	150 lb-in
Stud (Ring Lug)	Gnd		Limited by Ring Lug	4	45 lb-in
ST38 Terminal (Ring Lug)	DC Input + -	1000V / 600 Amps	Limited by Ring Lug	4	150 lb-in

3.4.1.3. SOURCE CONSIDERATIONS

- The main source for Model S3460BR is a battery bank. See Battery Selection Curves in Section 6.3.
- 3Ø input feed must be able to source the battery charging current and is sized according to the charger (typically 10A).

3.4.2. CONTROL INTERFACE WIRING

Most control and status signals are available from the 3460M6 interface board located at the upper left of the booster module front plate. Cabinets typically have an added terminal strip called TS1 with the most common connections for installation ease. Refer to Figure 3-4 for typical TS1 connections. Refer to Figures 3-6 and 4-1 for details. Refer to Section 4.2.1 for signal descriptions.

3.4.2.1. CONTROL CONNECTIONS

Cabinet systems common control connections are made at TS1 in top section of the cabinet backplate. See Table 3-3 for technical specifications, and Figures 3-1 and 3-2 for physical location.

*Not all control signals are available at this terminal strip. If more detailed status is desired, see Table 4-1.

3.4.2.2. STATUS MONITORING CONNECTIONS

Cabinet systems status monitoring connections are made at TS1 in top section of the cabinet backplate. See Table 3-3 for technical specifications, and Figures 3-1 and 3-2 for physical location.

*Not all status signals are available at this terminal strip. If more detailed status is desired, see Table 4-2.

Figure 3-4: Typical Control Connections at TS1



Table 3-3: Available Cabinet System Control and Status Connections

Connect to top of cabinet backplate.

TERMINAL TYPE	SIGNAL	FUNCTION	TERMINAL #	ELECTRICAL SPECS	MIN WIRE	MAX WIRE	TORQUE
Sak 2.5	DIS	Disable input	TS1	27mA @ 36V max	22	14	4.4 lb-in
Sak 2.5	RTA	Active output	TS1	120mA, 350VDC	22	14	4.4 lb-in
Sak 2.5	RTR	Ready output	TS1	120mA, 350VDC	22	14	4.4 lb-in
Sak 2.5	FLT	Fault output	TS1	120mA, 350VDC	22	14	4.4 lb-in
Sak 2.5	AUX	Aux output	TS1	1A, 460VAC	22	14	4.4 lb-in

Table 3-4: Open Backplate Module Control and Status Connections
Connect to M3460M6 PCB of Booster Module

TERMINAL TYPE	SIGNAL	FUNCTION	TERMINAL #	ELECTRICAL SPECS	MIN WIRE	MAX WIRE	TORQUE
Phoenix Plug	DIS	Enable / Disable input	TB7	27mA @ 36V max	22	14	2 lb-in
Phoenix Plug	TST	Test input	TB7	27mA @ 36V max	22	14	2 lb-in
Phoenix Plug	FLT	Fault output	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	RTR	Ready output	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	RTA	Active output	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	PCC	Pre-charge Complete	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	OT	Over Temperature	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	VF	Voltage Fault	TB5 & TB6	120mA 350VDC	22	14	2 lb-in
Phoenix Plug	IUV	Input Under Voltage	TB5 & TB6	120mA 350VDC	22	14	2 lb-in

Figure 3-5: Recommended RUN Command Wiring

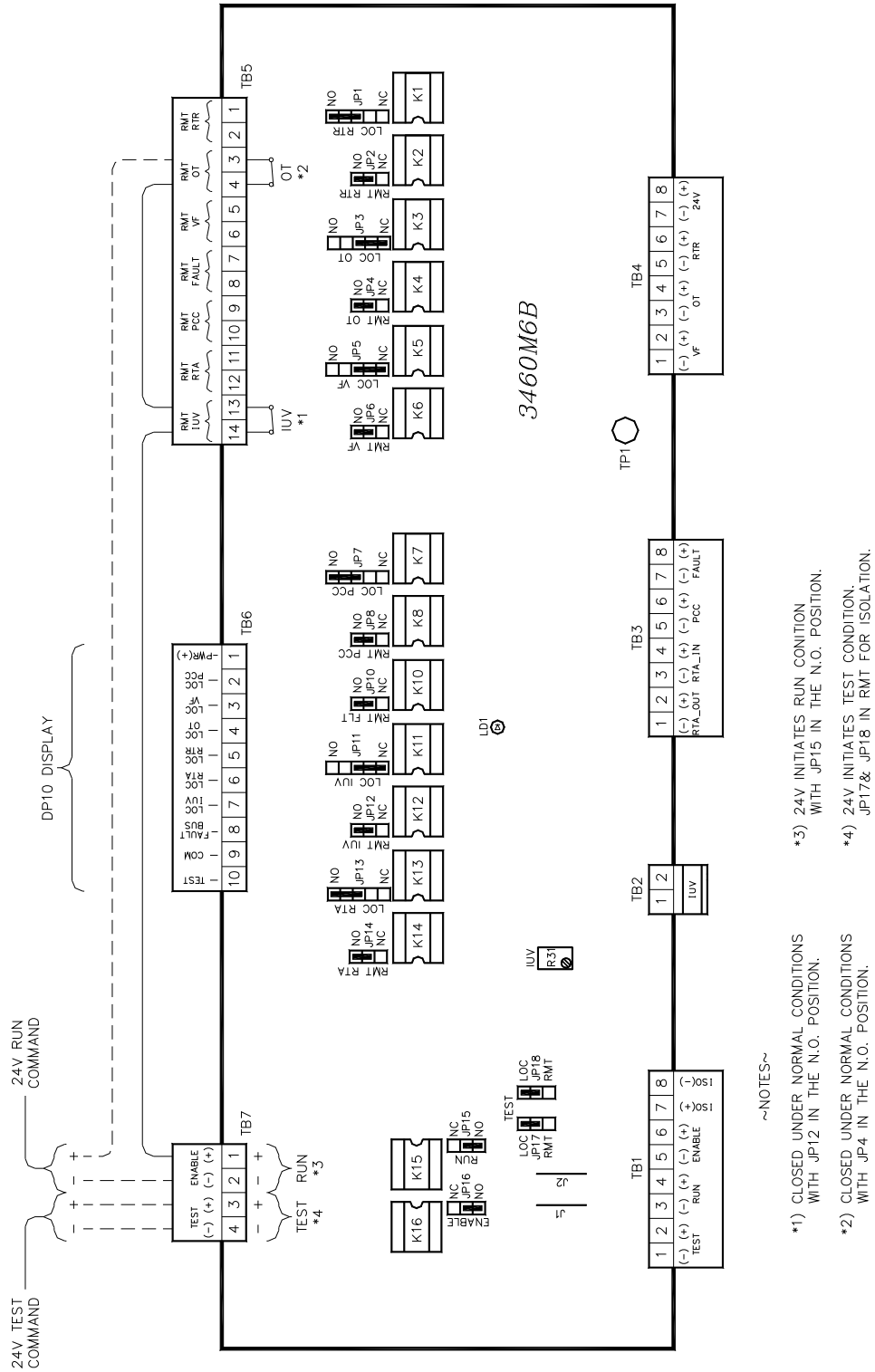


Figure 3-6: DP17 Connections to 3534I2

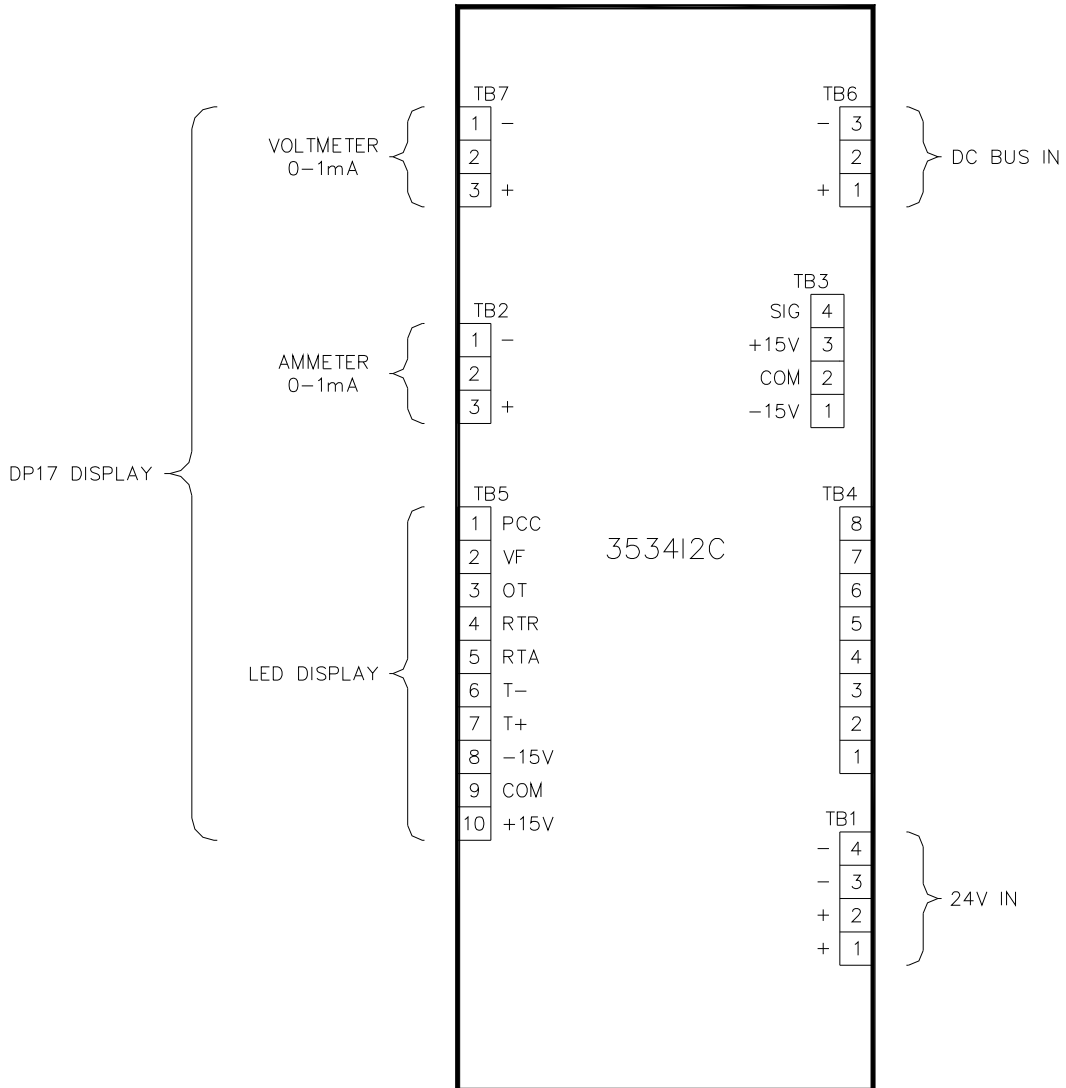
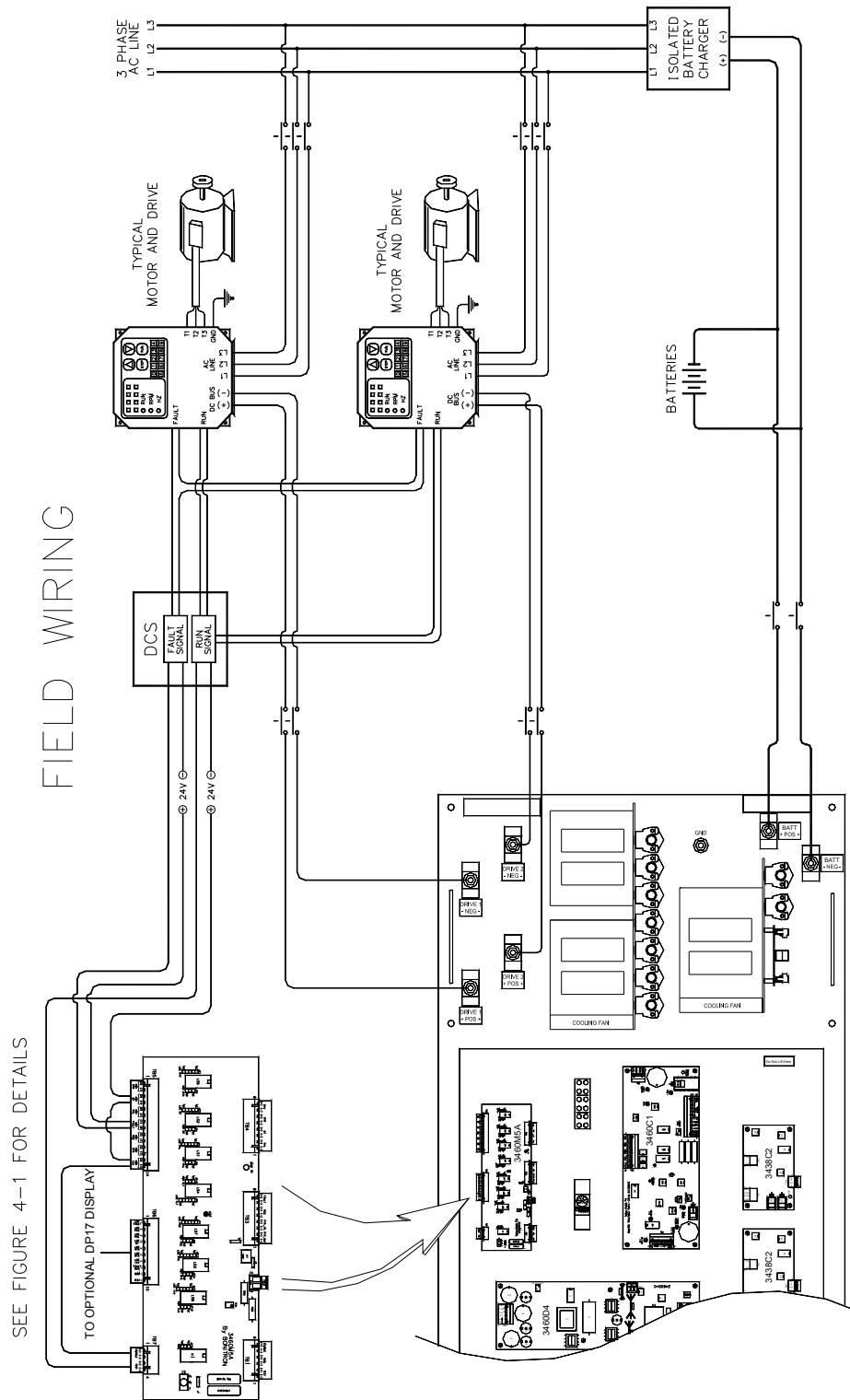
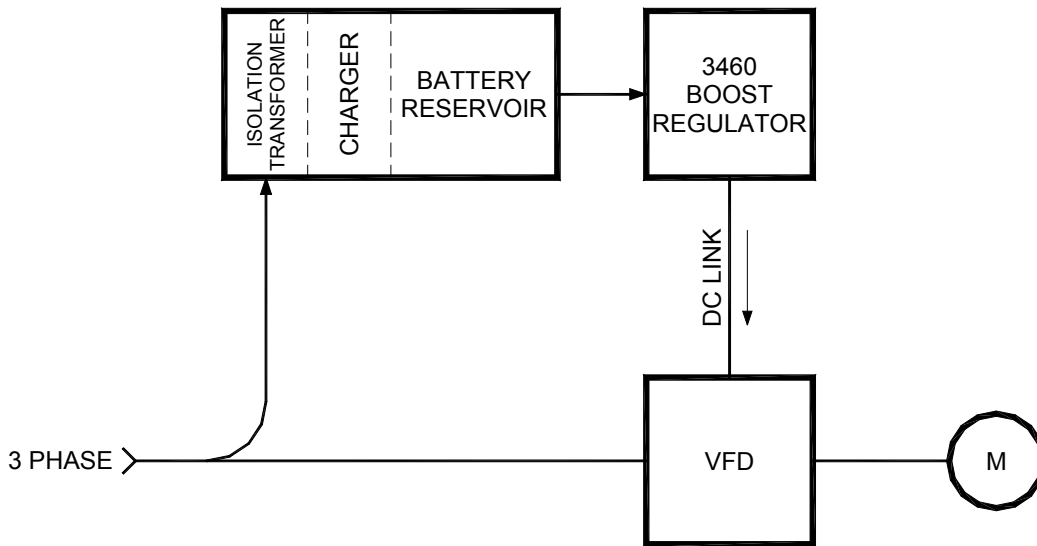


Figure 3-7: Typical Ride-Thru Field Connections
 (for RUN Command detail see Figure 3-5)



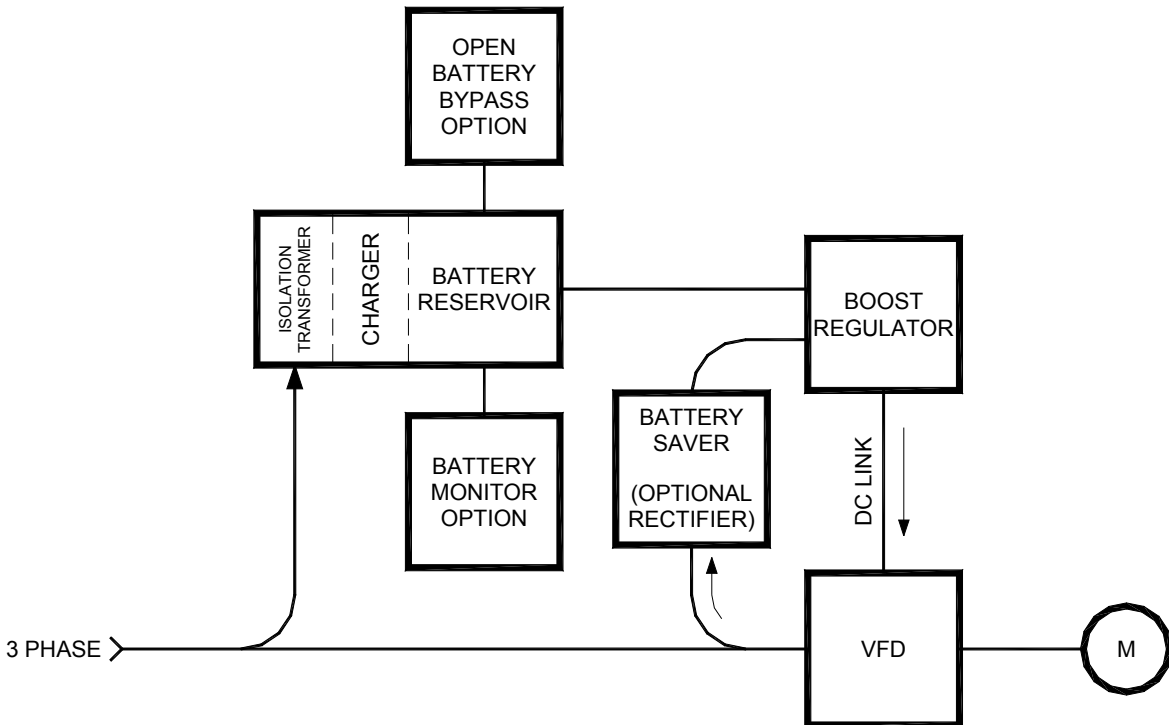
3.5. TYPICAL CONFIGURATIONS

Figure 3-8: DRT Ride-Thru System Configuration 4



ABOVE 50KW, 10 SECOND - 60 MINUTE, 100% OUTAGE PROTECTION
USING DC BOOSTER WITH BATTERY RESERVOIR

Figure 3-9: DRT Ride-Thru System Configuration 6



30 SECOND - 60 MINUTE, 100% OUTAGE PROTECTION
USING DC BOOSTER WITH PROTECTED BATTERY BANK

4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The S3460BR series of Drive Ride-Thru (DRTs) employs IGBT switching technology and energy storage banks to regulate the inverter DC bus to a preset minimum voltage level. As the incoming AC voltage disappears, the RTM “activates”, boosting the battery DC voltage up to the minimum DC bus voltage level specified for the inverter allowing it to “ride through” the sag or outage event. An external RUN command allows or inhibits boosting.

4.1.1. OPERATION DURING OUTAGE EVENT

During a voltage sag or outage, the inverter DC bus level will decrease, pulling the DRT bus down with it. Once the DC bus drops below a preset low limit “threshold” the RTM will become “active”. When this occurs, the **RT ACTIVE** front panel LED will illuminate, the internal **RTA** relay contact will change states, the cooling fan will begin running in order to cool the internal IGBT heatsink, and the DC bus level will be supported by the RTM. The **RT ACTIVE** LED and internal relay will be **ON** only while the RTM is active (real time). The cooling fan will continue running after activity stops.

As energy is drained, the battery voltage will drop and the RTM will regulate the bank voltage up to the threshold level. If the Open Battery Bypass Option is used, and a battery opens during discharge, that battery will automatically be bypassed and the battery monitor system will show which battery is bad. The RTM will make up the lost voltage and maintain the drive bus at threshold. If the battery voltage drops too low while the RTM is fully loaded, the output DC bus level will begin to drop. If the inverter’s **LOW BUS** trip level is reached, the inverter will shut down. When the DC bus drops to 350V, the RTM will shut down.

The M3528M2 battery bank voltage monitor is set to change states when the input DC battery bank voltage exceeds it’s minimum or maximum ratings. It is recommended to remove the booster RUN command if the battery bank drops below its recommended level in order to save the battery bank from deep discharge and the charger ENABLE if the bank rises above it’s limits to save from overcharging.

4.1.2. CONTINUOUS OPERATION

If the RTM begins supplying power continuously, possibly due to a low line level, overheated PTC devices, incorrect threshold adjustment, or inverter failure, an overtemp condition may occur. If this happens, the **OVERTEMP** front panel LED will turn **ON** and the internal **OT** relay will energize, shutting down the switching circuits and allowing the DC bus to drop to the nominal level. At this point, the RTM continues supplying power at the battery voltage level, but will not boost. Continuous currents can cause permanent damage. The **RTA** signal should not be active unless there is a power loss condition.

4.2. FEATURES

4.2.1. TERMINAL STRIP I/O

Connections for all of the Ride-Thru status and control signals described below are provided on the 3460M6 Fault Multiplex (MUX) interface board on all systems. Refer to Figure 3-7 for 3460M6 locations and to Figure 3-5 for details.

The 3460M6 Fault Multiplex interface board receives and monitors the various Ride-Thru system status signals. These signals are described in detail in this section. The board provides a pair of output signals (1 local, 1 remote) for each of the individual Ride-Thru status signals as well as for a multiplexed fault output. Local outputs are at TB6, are rated for 24V, and have a common for all signals at TB6-9. These are typically used for the local display panel. Remote outputs are at TB5, are valued for 24V, and each signal pair is isolated. All output contacts are jumper selectable for Normally Open or Normally Closed conditions to provide proper logic state.

4.2.1.1. RIDE-THRU CONTROL INPUTS

There are two inputs that affect control of the Battery Regulator Ride-Thru system: Enable and Test. Each of these inputs is described below.

ENABLE / DISABLE INPUT

The Ride-Thru may be configured for a 24V ENABLE or DISABLE signal via jumpers JP15 and JP16. N.O. position means the booster is enabled when 24V is applied; N.C. position means the booster is disabled with 24V applied.

The 3460M6 Status Interface board accepts a 24VDC ENABLE / DISABLE signal at TB7-1,2. In order to prevent accidental discharge of battery, IUV signal should be used to remove ENABLE input when battery bank drops below recommended value; and the OT signal should be used to remove the ENABLE in case the Booster Module overheats. (See Figure 3-5)

TEST INPUT

The Ride-Thru accepts a 15-24V signal for TEST and calibration purposes. This remote signal is connected across terminals TB7-3,4 of the 3460M6 Status Interface board. The TEST button is included on the DP17 Display Panel.

Initiating the TEST command will cause the Ride-Thru to raise the DC bus level by 100VDC. The inverter input current will drop and the Ride-Thru current will start. If the 3460C1 test time jumper J4 is set to EXT (External), the DC bus will remain raised for as long as the switch is pressed. If the 3460C1 test time jumper J4 is set to INT (Internal), the DC bus will remain raised for 2 seconds.

This test provides positive proof of Ride-Thru readiness. This test is also useful during field calibration of the Threshold Voltage. (See Section 4.4.1)

4.2.1.2. RIDE-THRU STATUS OUTPUTS

There are six Ride-Thru status signals that are monitored by the 3460M6 Fault Multiplex Interface board: INPUT UNDER-VOLTAGE (IUV), VOLTAGE FAULT (VF), OVER TEMPERATURE (OT), PRECHARGE COMPLETE (PCC), RIDE-THRU READY (RTR), and RIDE-THRU ACTIVE (RTA). Each of these signals, as well as a multiplexed fault output, is described below. See Figure 4-1 for the basic schematic.

The 3460M6 Status Interface board provides a pair of output signals (1 local, 1 remote) for each of the individual Ride-Thru status signals as well as for the multiplexed fault output. All output signals are rated at

350V, 120mA, 35Ω **ON**. All output signals are jumper selectable for normally open (N.O.) or normally closed (N.C.) conditions to provide proper logic state.

Local outputs are non-isolated and are suitable for display purposes. All local output connections are provided at TB6 on the 3460M6 board. Remote outputs are isolated and are suitable for use with a PLC interface. All remote output connections are provided at TB5 on the 3460M6 board.

INPUT UNDER-VOLTAGE (L-IUV & R-IUV)

The INPUT UNDER-VOLTAGE signal becomes active when battery voltage drops below the minimum requirements specified in Section 2 of this manual. Bonitron recommends this signal be used to remove the Enable below desired level.

This output is provided for field connection at terminals TB5-13,14 on the 3460M6 board.

VOLTAGE FAULT (L-VF & R-VF)

The VOLTAGE FAULT signal can be generated by a phase loss (50% sag models) or from an undervoltage on the output DC bus (100% outage models)

For phase loss this signal changes if any one phase is missing, or if all three phases are below 40% nominal rating.

For output under voltage the signal is factory set to change when the output DC bus drops about 25V below the threshold as set at time of production.

This output is provided for field connection at terminals TB5-5,6 on the 3460M6 board.

OVER TEMPERATURE (L-OT & R-OT)

The OVER-TEMP signal becomes active if the temperature of any heatsink or choke within the Ride-Thru unit exceeds 160°F.

This output is provided for field connection at terminals TB5-3,4 on the 3460M6 board.

PRE-CHARGE COMPLETE (L-PCC & R-PCC)

The PRECHARGE COMPLETE contact will become active when the DC bus has reached the preset pre-charge level.

This output is provided for field connection at terminals TB5-9,10 on the 3460M6 board.

RIDE-THRU ACTIVE (L-RTA & R-RTA)

The RIDE-THRU ACTIVE signal becomes active if the module is regulating the DC bus voltage under an input voltage sag condition. The RTA signal is also used by the fan relay via an on-board optical output. The Ride-Thru Active signal output has a hold time of approx. 2 seconds after the Ride-Thru Active condition is gone.

This output is provided for field connection at terminals TB5-11,12 on the 3460M6 board.

RIDE-THRU READY (L-RTR & R-RTR)

The RIDE-THRU READY contact will become active when the module is fully operational and capable of regulating the rated DC bus voltage under the specified power sag conditions.

This output is provided for field connection at terminals TB5-1,2 on the 3460M6 board.

MULTIPLEXED FAULT (L-FAULT & R-FAULT)

The VOLTAGE FAULT, OVER-TEMP, and RIDE-THRU READY signals from the system can be combined to provide a pair of multiplexed fault contact outputs.

For 3460M6-ver1: VF, OT, and RTR will cause fault to change.

For 3460M6-ver3: VF and OT will cause fault to change.

The multiplexed fault outputs are provided for field connection at terminals TB5-7,8 on the 3460M6 board.

4.2.2. LOCAL INDICATORS

THE FOLLOWING LED INDICATORS CAN BE FOUND ON THE 3460C1 PCB:

- +15V indicates that +15V is present
- -15V indicates that -15V is present
- RIDE-THRU ACTIVE indicates that the Ride-Thru is active
- RT READY indicates pre-charge has completed, run command is present, and there are no blown stage fuses
- PRECH COMPL indicates pre-charge has completed and run command is present
- TEST indicates test is in progress
- BLOWN FUSE indicates that a stage fuse is blown

THE FOLLOWING LED INDICATORS CAN BE FOUND ON THE 3460M6 PCB:

- NO FAULT
 - ON indicates that no fault is present and system is OK

THE FOLLOWING LED INDICATORS CAN BE FOUND ON THE 3460D5 PCB:

- **BUS OK**
 - ON indicates that DC bus is above theoretical drive under-voltage shutdown level
- +23V indicates that +23V supply is present
- -23V indicates that -23V supply is present
- 23V ISO indicates isolated 23V supply is present

Figure 4-1: Status & Control Field Connections (3460M6 Basic Schematic)

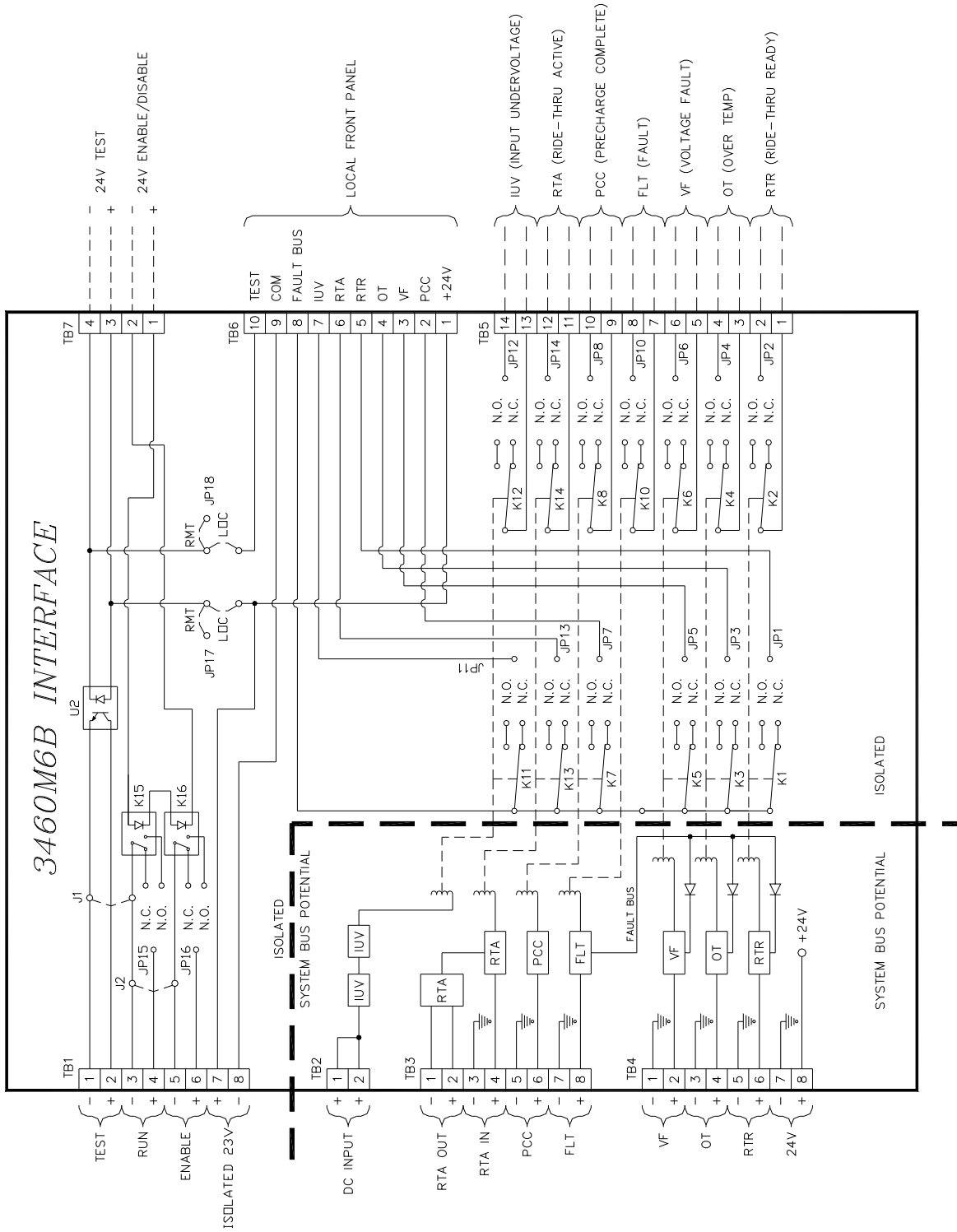


Table 4-1: Control Signal Specifications

CONTROL / STATUS SIGNAL	SIGNAL SPECS	ACTIVE STATE
Enable / DISABLE Input	17mA @ 24VDC	24VDC to run
Test Input	17mA @ 24VDC	24VDC to test
Ride-Thru Status Outputs	Jumper selectable N.O. / N.C. OptoFET 350V @ 120mA	Jumper selectable (see Fig 35, 4-1 and Table 4-2)

Table 4-2: 3460M6 Fault Multiplex Interface I/O Signal Logic Jumper Details

STATUS SIGNAL	OUTPUT	LOCAL / REMOTE	LOGIC STATE JUMPERS		OUTPUT TERMINALS
			JUMPER	FACTORY SETTING	
Multiplexed Fault	L-FAULT	Local	none	Normally CLOSED (N.C.)	TB6-1,9
	R-FAULT	Remote	JP10	Normally OPEN (N.O.)	TB5-7,8
Pre-charge Complete	L-PCC	Local	JP7	Normally OPEN (N.O.)	TB6-2,9
	R-PCC	Remote	JP8	Normally OPEN (N.O.)	TB5-9,10
Voltage Fault	L-PHL	Local	JP5	Normally CLOSED (N.C.)	TB6-3,9
	R-PHL	Remote	JP6	Normally OPEN (N.O.)	TB5-5,6
Over Temperature	L-OT	Local	JP3	Normally CLOSED (N.C.)	TB6-4,9
	R-OT	Remote	JP4	Normally OPEN (N.O.)	TB5-3,4
Ride-Thru Ready	L-RTR	Local	JP1	Normally OPEN (N.O.)	TB6-5,9
	R-RTR	Remote	JP2	Normally OPEN (N.O.)	TB5-1,2
Ride-Thru Active	L-RTA	Local	JP13	Normally OPEN (N.O.)	TB6-6,9
	R-RTA	Remote	JP14	Normally OPEN (N.O.)	TB5-11,12
Input Under-voltage	L-IUV	Local	JP11	Normally CLOSED (N.C.)	TB6-7,9
	R-IUV	Remote	JP12	Normally OPEN (N.O.)	TB5-13,14

4.2.3. LOCAL METERS AND COUNTERS

Local meters or counters are included with the Display Panel.

4.2.4. DISPLAYS

DP17 and DP18 Display Panels are included with the "BR" cabinet system.

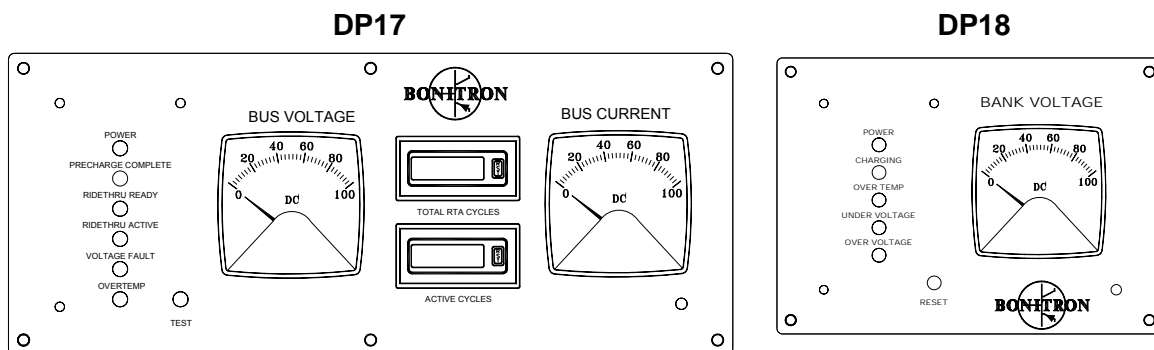
4.2.5. DIAGNOSTIC DISPLAY PANEL

The Ride-Thru Diagnostic Display Panel provides visual indication of the Ride-Thru module's operating status and also permits a system test to be performed. The features of the DP17 and DP18 are detailed in Table 4-3 and Figure 4-2.

Table 4-3: Diagnostic Display Panel Configurations

PANEL NUMBER	LEDS & SWITCH	METERS		COUNTERS		PANEL DIMS.
		VOLTMETER	AMMETER	TOTAL CYCLES	ACTIVE CYCLES	
DP17	✓	✓	✓	✓	✓	5" x 12"
DP18	✓	✓				5" x 7"

Figure 4-2: Diagnostic Display Panels



4.2.5.1. DP17 FRONT PANELS FOR BOOST SECTION STATUS

The System Status Display module provides visual indication of various system functions. The monitored functions include POWER, PRECHARGE COMPLETE, RIDETHRU READY, RIDETHRU ACTIVE, VOLTAGE FAULT, and OVERTEMP. In addition, this module provides the system TEST switch required for threshold voltage adjustments and system calibration. The functions of each of these indicators are described below. See Table 4-4.

POWER LED

The green POWER LED is ON if power is applied to the system.

(PCC) PRECHARGE COMPLETE LED

The green PRECHARGE COMPLETE LED is ON if the DC bus has reached the factory preset precharge level.

(RTR) RIDETHRU READY LED

The green RIDETHRU READY LED is ON if the module is fully operational and capable of regulating the rated DC bus voltage under the specified power sag conditions.

(RTA) RIDETHRU ACTIVE LED

The amber RIDETHRU ACTIVE LED is ON if the module is regulating the DC bus voltage under an input line sag condition.

VOLTAGE FAULT

The red VOLTAGE FAULT LED is ON if any single phase of the AC line input is missing for 50% sag models, and ON if the DC bus drops 25V below the threshold for battery regulator models.

OVERTEMP LED

The red OVERTEMP LED is ON if the temperature is excessive on any M3460B heatsink or choke.

TEST SWITCH

The TEST SYSTEM push-button switch will cause the Ride-Thru section to raise the DC bus threshold by 100VDC. The inverter input current will drop and the Ride-Thru current will start. If the 3460C1 test time jumper (J4) is set to "EXT", the DC bus will remain raised for as long as the switch is pressed. If the 3460C1 test time jumper (J4) is set to "INT", the DC bus will remain raised for 2 seconds. If this is done under load, time-out will occur in 2 seconds.

This test provides definite proof of Ride-Thru readiness and is also useful during field calibration of the Threshold Voltage.

BUS VOLTAGE METER (DP17)

The Bus Voltage meter indicates the Ride-Thru DC bus voltage. The voltmeter is driven from the 3534I2 board. The 3534I2 board uses a voltage divider connected across the DC bus to drive the panel meter with 300k ohm impedance between the meter and each \pm bus. The Voltmeter will read slightly lower than the drive bus when idle.

BUS CURRENT METER (DP17)

The Bus Current meter indicates the positive DC bus current supplied by the Ride-Thru module. The current is sensed by an isolated Hall Effect device and the meter is driven from the 3534I2 board.

ACTIVE CYCLES COUNTER (DP10, DP11, DP17)

The Active Cycles Counter indicates the number of times the Ride-Thru module has been active since this counter was last reset. The counter is battery powered and therefore does not lose its count during a power outage. The counter may be reset to zero by pressing the Reset push-button. This button is located to the right on the front face of the counter.

TOTAL RTA CYCLES COUNTER (DP16, DP17)

The Total RTA Cycles Counter indicates the lifetime total number of times the Ride-Thru module has been active. The counter is battery powered and therefore does not lose its count during a power outage. This counter is not affected by the Reset push-button located to the right on the front face of the counter.

4.2.5.2. DP18 FRONT PANELS FOR STORAGE SECTION STATUS

POWER LED

The green POWER LED is ON if power is applied to the system.

CHARGING LED

The CHARGING LED is ON while the battery bank is accepting full charge current. This LED goes OUT as the battery becomes fully charged and the current drops below approx 1 amp.

OVERTEMPERATURE LED

The OVER TEMP LED comes ON if the charger overheats, or if the charger AC power is removed during an outage. This LED should be ignored during a power loss.

UNDER VOLTAGE LED

The UNDER VOLTAGE LED will be ON if the cap bank is below a level where the booster can no longer supply full threshold voltage. (Typically ½ full bus voltage)

OVER VOLTAGE LED

The OVER VOLTAGE LED will be ON if the cap bank is over charged. This LED is only used with the 3528M2 voltage monitor option.

RESET PUSHBUTTON

The RESET button will reset the under / over voltage monitor if tripped. This button is only used with the 3528M2 voltage monitor option.

BANK VOLTAGE METER

The Bank Voltage meter indicates the battery bank voltage. The meter is driven through a 300k ohm impedance.

4.2.5.3. 3528M2 VOLTAGE MONITOR

The M3528M2 Module monitors a DC voltage connected to the input terminals.

The module has two voltage setpoints, one each for the overvoltage and undervoltage, which are set by the user via potentiometers. When the monitored voltage reaches either setpoint, that channel's output relay will change state, triggering whatever signaling device the user connects to it. By default, the output relay will return to its original state when the monitor voltage returns to within the range between setpoints, accounting for hysteresis. However, the module's jumpers can be configured so that the output change will latch until a latch reset signal is received, the latch jumper is removed, or power is disconnected from the board.

Overvoltage and Undervoltage outputs are used to control the Overvoltage and Undervoltage LEDs on the DP18 panel. See M3528M2 manual for more detailed information.

Key for Table 4-4: System Status Display Reference Tables:

X = on

O = off

Table 4-4: System Status Display Reference Tables

POWER-UP	DP17	SITUATION	PWR	PCC	RTR	RTA	VF	OT
		Power up, fully charging	X	X	X	O	O	O
		Power up, fully charging, battery bank below minimum voltage	X	X	X	O	O	O
		Power up, fully charging, battery bank above maximum voltage	X	X	X	O	O	O
		Power up, fully charged & ready	X	X	X	O	O	O
	DP18	SITUATION	PWR	CH	OT	UV	OV	
		Power up, fully charging	X	X	O	O	O	
		Power up, fully charging, battery bank below minimum voltage	X	X	O	X	O	
		Power up, fully charging, battery bank above maximum voltage	X	X	O	O	X	
		Power up, fully charged & ready	X	O	O	O	O	
TEST	DP17	SITUATION	PWR	PCC	RTR	RTA	VF	OT
		Test, lightly loaded	X	X	X	X	O	O
	DP18	SITUATION	PWR	CH	OT	UV	OV	
		Test, lightly loaded	X	O	O	O	O	
POWER-OFF	DP17	SITUATION	PWR	PCC	RTR	RTA	VF	OT
		Power up, fully charged & ready	X	X	X	O	O	O
		Power off, unloaded	X	X	X	O	O	O
		Power off, lightly loaded	X	X	X	X	O	O
		Power off, unloaded, loaded batteries at minimum level	X	X	X	X	O	O
	DP18	SITUATION	PWR	CH	OT	UV	OV	
		Power up, fully charged & ready	X	O	O	O	O	
		Power off, unloaded	X	O	O	O	O	
		Power off, lightly loaded	X	O	O	O	O	
		Power off, unloaded, loaded batteries at minimum level	X	O	O	X	O	
CHARGING	DP17	SITUATION	PWR	PCC	RTR	RTA	VF	OT
		Initial charge	X	X	X	O	O	O
		Full charge	X	X	X	O	O	O
	DP18	SITUATION	PWR	CH	OT	UV	OV	
		Initial charge	X	X	O	O	O	
		Full charge	X	O	O	O	O	
DISABLE	DP17	SITUATION	PWR	PCC	RTR	RTA	VF	OT
		RT control disabled	X	O	O	O	O	O
	DP18	SITUATION	PWR	CH	OT	UV	OV	
RT control disabled		X	O	O	O	O		

4.3. S3460BR RIDE-THRU FIELD START-UP PROCEDURE



The S3460BR uses an external battery bank for energy storage. Be aware that high voltages will exist inside the cabinet once batteries are reconnected after shipment. Only qualified electricians should complete this start up procedure. Protective clothing and gloves should be worn when installing this equipment. Failure to heed this warning may result in severe bodily injury or death.

1. Ensure the Bonitron Ride-Thru has been properly installed.
 - Use Installation Procedure in Section 3.
2. Ensure the Battery Cabinet has been properly installed.
 - Use documentation provided by the battery cabinet manufacturer.
3. The Ride-Thru DC bus threshold must be coordinated with the under voltage trip setting of the inverter. If the threshold is too close to the nominal bus, the Ride-Thru may supply power to the drive continuously, and overheat. If the threshold is too close to the under voltage trip level of the inverter, the system may not "Ride-Thru", and under voltage trips will still occur. Most inverters have an under voltage trip point of -15% of nominal. Some inverters can be reprogrammed to change this trip level. Bonitron typically would like the DC bus threshold to be about -10% of the nominal bus. For example, Bonitron sets all 460VAC systems to hold the DC bus to 585VDC.
 - Confirm inverter under voltage trip point if possible.
 - Refer to your inverter's documentation for details on adjustment of the under voltage trip setting.
 - Some inverters automatically change this setting when the main voltage is programmed, and is typically 80-85% of full DC bus voltage.
 - Some inverters do not allow adjustment.
 - Refer to Section 4.4 for details on how the Ride-Thru DC bus threshold can be changed.
4. If start-up must be done during production runs, disable the inverter ground fault until testing can be done. See Section 7.3, step 9.
5. If equipped with the Ride-Thru disconnect, turn off, and apply power to the system. Otherwise, go to the Startup Procedure Section 4.3.2.
6. Ensure that the associated inverter is working properly.
 - Confirm the under voltage trip point if possible.

The Bonitron Power Source Ride Thru system can be powered from the AC line or from the internal battery bank. Remember that once batteries are plugged in there are lethal voltages inside the cabinet and protective clothing should be worn to decrease the shock hazard.

4.3.1. INITIALIZING THE BATTERY BANK



As battery banks are connected, high voltage levels will be present inside the cabinet. Be careful around these high level DC voltages! Insulating gloves should be worn while standing on an insulated mat when touching battery terminals!

1. Verify that battery disconnect switch is OFF.
2. Initialize the battery bank by re-installing jumpers.
 - Refer to battery cabinet documentation.
3. Measure battery string voltage at battery cabinet breaker.

- Should measure between Nominal and Full or Float Voltage. (See Table 6-4)
- Ensure polarity is correct before closing breaker.

4.3.2. POWERING UP FROM BATTERY BANK

Refer to Table 4-4 for indications during various operating circumstances.

1. With the Ride-Thru cabinet door disconnect turned off, apply power to the Booster and Charger modules by turning on the battery disconnect switch and observe the following conditions on the DP17 and DP18 Display panels:
 - DP17 POWER LED should be **ON**.
 - DP17 PRECHARGE COMPLETE LED should be **ON**.
 - DP17 RIDE-THRU READY LED should be **ON**.
 - DP17 RIDE-THRU ACTIVE LED should be **ON**.
 - DP17 VOLTAGE FAULT LED should be **OFF**.
 - DP17 OVERTEMP LED should be **OFF**.
 - DP17 The BUS CURRENT meter should read **0** amps.
 - DP17 The BUS VOLTAGE meter should read “threshold” DC bus voltage.
 - DP18 POWER LED should be **ON**.
 - DP18 CHARGING LED should be **OFF** (until AC power is applied).
 - DP18 OVER TEMP LED should be **OFF**.
 - DP18 UNDER VOLTAGE LED will be **ON** if the battery bank voltage is below the minimum required to maintain the load.
 - If UV LED is incorrect, initiate RESET from the Display Panel.
 - DP18 OVER VOLTAGE LED should be **OFF**.
 - If OV LED is incorrect, initiate RESET from the Display Panel.
 - DP18 Bank Voltage meter reading will read battery bank voltage.



Booster and Charger use thermistors in their start up circuits. If thermistors are still warm when power is reapplied, there may be a few second delay before power up sequence occurs. If AC power is not applied, and the batteries are connected, the charger will cycle its start up circuitry until the power returns. Do NOT leave in this condition for extended periods.

2. Verify external alarm connections if it is considered important to know if the Ride-Thru is not ready for the next power sag, before it happens.
 - DCS should read the state of the fault contact when connected to TS1 as shown in Figure 3-4, or when connected directly to the 3460M6.
 - Contacts will change states when fault occurs from the following conditions:
 - Booster over temp.
 - Voltage fault.
 - DISABLE Command (Jumpers on 3460M6 interface).
3. Compare DC bus voltages.
 - Check for proper polarity on both sides of main disconnect switch.
 - Booster DC output is factory set for **585VDC** and can be measured at the bottom of cabinet disconnect switch.

- Inverter DC Bus should be no less than **25VDC** above this threshold when normally loaded, can be as high as 750VDC unloaded, and can be measured at the top of disconnect switch.
4. Close door and turn on Bonitron cabinet disconnect.
 - Battery voltage will rise slightly to begin recharging batteries depending on state of charge.
 - Positive battery current of up to charger rating may be seen depending on state of charge.
 - In the case of trouble shooting inside the cabinet with door disconnect cheated, the following indications can be seen:
 - Booster **ACTIVE** LED goes **OUT**.
 - Charger **DISCHARGE** LED goes **OUT**, **CHARGE** LED remains **ON**, and **CURRENT LIMIT** LED may come **ON** depending on state of charge.
 5. Verify Ride-Thru capability by removing power from the system. Load drive to the greatest extent possible.
 - Cabinet **ACTIVE** lamp will come **ON** for duration of event.
 - Battery voltage will drop from charge level of 540VDC to 505VDC, and begin falling as batteries discharge.
 - DP17 current meter will show current flowing out of the DRT into the drive bus.
 - Inverter DC bus will drop to the Bonitron threshold level of approximately 575VDC when fully loaded.
 - Inverter should be able to keep motor speed and torque constant.
 - In case for trouble shooting inside of cabinet with door disconnect cheated the following indications can be seen:
 - Booster **ACTIVE** LED will come **ON** for duration of event.
 - Charger **CHARGE** and **CURRENT LIMIT** LEDS should go **OFF**.
 - Battery **FAULT** LEDS should remain **OFF** when load and time frame of usage remains within specifications.

This completes the start up procedure.

4.4. OPERATIONAL ADJUSTMENTS

4.4.1. THRESHOLD VOLTAGE AND LOW BUS SENSE ADJUSTMENT PROCEDURES FOR S3460BR CABINET SYSTEMS

This section provides the basics on Threshold Voltage and Low Bus Sense Adjustment Procedures for Model S3460BR Ride-Thru Systems. **Please read through this section in its entirety before proceeding. See the M3460B manual for more detail.**

See Figures 7-2 and 7-3 for Typical Drive Bus Voltages.

4.4.1.1. OVERVIEW

The threshold voltage level is the voltage at which the 3460 Ride-Thru Module maintains the DC bus during a power sag. Whenever the DC bus level drops to the threshold setpoint, the Ride-Thru Module becomes active to regulate the DC bus voltage to the threshold setpoint voltage.

Generally, the threshold level should be set at 10-15% below the nominal DC bus level. An actual on-site level setting must be

determined by the loaded DC bus level as well as the amount of ripple present on the DC bus. The Ride-Thru Module should not become ACTIVE during normally everyday operation.

The Threshold level is factory preset on all Bonitron 3460 Ride-Thru Modules. These levels are specified in the Voltage Specifications section of the Customer Reference manual for each Ride-Thru module. However, some field adjustment of this level may be required to achieve the optimum setpoint level for any given system.

It is important to note that the Ride-Thru module's LOW DC BUS or VOLTAGE FAULT (VF) setpoint is factory preset to approximately 5% below the threshold voltage. This setpoint should be maintained at approximately 5% below threshold to avoid improper VF activity.

*** Please note that not all models are wired to utilize the VOLTAGE FAULT. ***

Table 4-3 lists the typical factory setpoints for the threshold, LOW DC BUS (VF) and TEST BOOST levels for the 3460 Ride-Thru Modules based on the system AC or DC input voltage requirements.

Table 4-5: Factory Setpoints for Threshold and Test Boost Voltages

SYSTEM AC VOLTAGE	MINIMUM INPUT VOLTAGE (IUV)	THRESHOLD	LOW DC BUS (VF)	TEST BOOST
230	200VDC	285VDC	260VDC	+50VDC
380	340VDC	485VDC	460VDC	+75VDC
400	350VDC	495VDC	470VDC	+100VDC
415	360VDC	505VDC	480VDC	+100VDC
460	400VDC	585VDC	560VDC	+100VDC

* Any ripple on the DC bus will be sensed by the control circuits. A multimeter may not show ripple valleys that drop below the threshold causing activity. In this case, an oscilloscope should be used.

4.4.1.2. DETERMINING THE THRESHOLD VOLTAGE SETPOINT

Testing and adjustment of the threshold voltage setpoint can be performed on systems in either an "On-line and loaded" or an "Off-line and unloaded" condition.

Monitor both the drive and booster DC bus levels. The drive DC bus should be higher than the Booster DC bus. If it is not, the Booster will constantly feed the drive bus, and this is an undesirable condition.

1. For single and dual output systems open the disconnect switch between Booster and Drive DC busses. For multiple output systems remove AC from the 300W power supply.
 - Drive bus remains the same
 - Booster DC bus begins to drop towards threshold level
2. Once Threshold has been reached, the Booster will become active
 - RTA indicator will turn on
 - Booster begins to fire or "tick"
 - Energy is taken out of the battery

- DC bus should not drop any lower, and will vary a few volts with each firing.
3. Read DC bus voltage at output of Booster and compare to levels as shown in Table 4-5.
- Adjust pot on 3460C1 control board if needed. (See booster manual M3460B for pot location.)
 - a. CW increases Threshold Level
 - b. CCW decreases Threshold Level



CAUTION!

Make sure the threshold is set properly for the actual system parameters, particularly the difference between the drive normal "loaded and running" bus voltage and the DRT threshold voltage.



ATTENTION!

If threshold is changed in the field, output undervoltage adjustment should be made by equivalent amount.

5. MAINTENANCE AND TROUBLESHOOTING

Repairs or modifications to this equipment are to be performed by Bonitron approved personnel only. Any repair or modification to this equipment by personnel not approved by Bonitron will void any warranty remaining on this unit.

5.1. PERIODIC TESTING

The Bonitron S3460BR Ride-Thru System is designed to be low maintenance. However the connected energy storage battery bank will degrade over time, and should be periodically checked. Bonitron recommends a yearly test of the system in order to ensure the electronics package is operating properly, and the storage bank has proper capacity. The following steps can be taken to ensure reliability and give comfort that the system is still able to Ride-Thru an outage event.

5.1.1. PERIODIC MAINTENANCE PROCEDURE FOR S3460BR WITH OPTIONAL DISPLAY PANEL

1. Check Active cycle counters.
 - More than 10 counts per month may mean the Ride-Thru is improperly adjusted. Refer to Section 4.4.1.2 for adjustment details.
 - Note count for Factory records.
 - Report count to Bonitron via your local service representative.
2. Monitor front panel LEDs in standby mode.
 - For the DP17 Display Panel:
 - Power LED should be **ON**.
 - Pre-charge Complete LED should be **ON**.
 - Ride-Thru Ready LED should be **ON**.
 - Ride-Thru Active LED should be **OFF**.
 - Voltage Fault LED should be **OFF**.
 - Over-temperature LED should be **OFF**.
3. Verify DC bus current meter.
 - Meter should read zero amps under normal conditions.
4. Verify DC bus voltage meter.
 - Ride-Thru bus should be about 10 – 25VDC below the Inverter bus.
 - DC voltmeter should read within 1% of calibrated multimeter.
5. Verify Threshold by opening the DC disconnect between the Ride-Thru module and inverter DC bus. Refer to Section 4.4.1.2.
 - The DC bus voltage should **drop** until it reaches the threshold.
 - Ride-Thru Active LED should begin to **flash**.
 - DC bus should **hold** at the threshold.
 - This threshold level should be 20 – 30 volts **below** the normal LOADED inverter DC bus.

To verify Threshold using the TEST feature, refer to the M3460B manual.

Re-close the disconnect between Ride-Thru and inverter.

Each Bonitron Ride-Thru should be tested under load during initial start up to verify the functionality of the test circuit and that the test does not negatively affect the process. However, Bonitron recommends that, if the process is critical, the test cycle be initiated only during a shutdown to avoid unforeseen problems.

6. Verify switching circuits by pressing the TEST button while running the inverter at full load.
 - Ride-Thru DC bus current should flow during the 2-second test cycle.
 - Inverter input current should **drop**.
 - Ride-Thru DC bus voltage should rise above the threshold.
 - Inverter DC bus voltage should rise to the same level minus 1.4V.
 - Ride-Thru Active LED should turn **ON**.
 - Active cycle counter should **increment**.
 - Motor speed should **remain constant**.
7. Verify energy storage bank charge by removing AC power to the inverter simulating an outage event.
 - The DC bus voltage should **drop** to the threshold.
 - Ride-Thru Active LED should turn **ON**.
 - Active cycle counter should **increment**.
 - DC bus should **hold** at the threshold.
 - Battery voltage should eventually drop.
 - Inverter should continue to run **normally**.
 - Motor speed should **remain constant**.

Re-apply AC power to inverter input.

This completes the maintenance procedure.

5.2. MAINTENANCE ITEMS

5.2.1. HEATSINK FANS

The worst case life expectancy for the Papst fans would be 37,000 hours (4.23 years) of running @ 50°C. If adjusted properly the RTM should only be active once every power outage. In this case the fans will only run for two hours every time the power is lost. Since the fans are set to run for 2 hours after any activity, this translates into over 18,000 Ride-Thru events.

The answer for maintenance interval then depends upon the amount of time the fan is running, the amount of dirt in the air, and the ambient temperature of the cabinet.

Bonitron estimates fan life to be longer than 20 years in a properly adjusted Ride-Thru in a clean cool environment, 4 years under constant running conditions with high ambient temperatures.

5.2.2. HEATSINKS

Dirt can build up on heatsink surfaces degrading its ability to dissipate heat.

The heatsinks should be checked for large amounts of deposits and cleaned as needed. The maintenance interval depends upon the amount of activity and the environment inside the cabinet.

Checking the heatsink should be included when checking for fan operation.

5.2.3. CAPACITOR REPLACEMENT CRITERIA

Bonitron Model M3460B booster uses high quality aluminum electrolytic capacitors and is designed for long life without maintenance. While a typical inverter may require capacitor replacement after a certain time due to the heavy ripple currents, the M3460 typically is in a standby mode waiting for a power disturbance, and by design has 50% more capacitance than needed.

The capacitor manufacturer has given a rating of 11 years MTBF if ambient

temp is 50°C, capacitors are held at 100% rated voltage, and caps run full ripple current at 1% duty.

With typical operating conditions of 35°C, caps running at 75% rated voltage, and a duty cycle of one sag per month, Bonitron recommends the capacitors be checked after 10 years of operation, and every 2 years after, with replacement in 20 years.

The recommended test is to measure the voltage across each series set of capacitors. Any voltage difference greater than 15% between each set of series caps would indicate a change in value in one cap and would constitute a more detailed out of circuit capacitance check. (A difference of 5% is allowed at time of production.)

5.2.4. CAPACITOR TESTING PROCEDURE

1. Remove power to unit and wait for DC bus to drain.
2. Install Gate drive board extension cables to allow the top panel door to open exposing the capacitor bank.
3. Re-apply power and measure voltage across each cap and make note for future reference.
 - Any voltage difference more than 15% indicates a substantial change in capacitance.
 - Example: DC bus = 540V, each series cap = 270V. 15% of 270 = 40.5V cap 1 = 290V, cap 2 = 250V.
4. Remove power and replace both capacitors.

5.2.5. BATTERY MAINTENANCE

Battery cabinets used with Bonitron's S3460BR systems are designed and built by other manufacturers. Maintenance should be carried out in accordance with the battery manufacturer's recommendations.

Bonitron suggests a yearly test of the system under actual load of application. If this is not possible, batter bank load testers are available from Bonitron as well as other manufacturers.

5.3. TROUBLESHOOTING

SYMPTOM	ACTION
No LEDs	<ul style="list-style-type: none"> • Check incoming power • Check power supply 3460D5 for all voltages – replace 3460D5 if incorrect
No +15 or -15 LEDs	<ul style="list-style-type: none"> • Check power supply 3460D5 for all voltages. – replace 3460D5 if incorrect • If OK, then replace 3460C1 control pcb
System Fault	<ul style="list-style-type: none"> • Check 3460M6 Green Fault LED – if ON check system wiring. • Check 3460M6 inputs at TB4 – <ul style="list-style-type: none"> ▪ If all low replace 3460M6 ▪ If any one is high: <ul style="list-style-type: none"> • RTR – follow No RTR • OT- follow overtemp ▪ VF – Low output voltage can cause fault. See threshold adjustment procedure for voltage levels
No RTR on DP17	<ul style="list-style-type: none"> • Check for run command • Check stage fuses – look for blown fuse LED on 3460C1 • Check 3460M6 interface • IF OK replace 3460C1 control pcb
No PCC on DP17	<ul style="list-style-type: none"> • Check DC bus level – if not OK check pre-charge ckts or bus caps • Check for run command • Check stage fuses – look for blown fuse LED on 3460C1 • Check 3460M6 interface • IF OK replace 3460C1 control pcb
No VF on DP17	<ul style="list-style-type: none"> • Check DC bus voltage level at input to 3460D5 <ul style="list-style-type: none"> ▪ With nominal DC bus level this is normal ▪ Readjust if OUV doesn't change states when bus drops below setpoint. see threshold adjustment procedure • If adjustment will not allow OUV, replace 3460M6
Constant VF on DP17	<ul style="list-style-type: none"> • Check DC bus voltage level at input to 3460D5 <ul style="list-style-type: none"> ▪ Readjust if bus level is OK, see threshold adjustment procedure ▪ With no run command and no drive bus connected this is normal <ul style="list-style-type: none"> • output will = battery input and cause VF fault ▪ If unit has "timed out" and no drive bus is connected this is normal <ul style="list-style-type: none"> • output will = battery input and cause VF fault
RTA always ON	<ul style="list-style-type: none"> • Check DC bus levels on both sides of diodes • Check for overheated pre-charge ckt <ul style="list-style-type: none"> ▪ Too much activity can cause stage fuse failures, overheating and draining of the battery • Check threshold level, if changed over time adjust level or replace 3460C1 • Check J1 TIME OUT jumper on 3460C1
RTA never ON	<ul style="list-style-type: none"> • Check RUN command • Initiate test cycle or remove power <ul style="list-style-type: none"> ▪ Watch and listen for signs of activity <ul style="list-style-type: none"> • Check RTA contact and LEDs • Ticking sound when active • Check power quality data to confirm sag events should have caused activity to occur • If no activity ever replace 3460C1

SYMPTOM	ACTION
RTA ACTIVE for short periods only	<ul style="list-style-type: none"> • Check 3460C1 J1 TIME OUT jumper <ul style="list-style-type: none"> ▪ If OFF, unit will only run 2 seconds at full load
Overtemp	<ul style="list-style-type: none"> • Check for constant current on the negative and positive DC bus links • Check temp sensors <ul style="list-style-type: none"> ▪ On SCR heatsink ▪ On diode heatsinks ▪ On IGBT heatsinks ▪ On chokes (if used) • Check pre-charge network for overheating – (cause of constant activity) • If all OK replace 3460M6 interface pcb • Check activity record –too much activity causes overtemp
Blown Fuse LED ON	<ul style="list-style-type: none"> • Check stage fuses – indicator on BLOWN FUSE will be tripped • If all stage fuses are OK replace 3460C1 control pcb
Blown stage fuses	<ul style="list-style-type: none"> • Check for shorted IGBT <ul style="list-style-type: none"> ▪ Replace 3438C2 gate driver if IGBT is bad • Check or replace stage choke current sensor • Check or replace 3438S stage IGBT snubber • Check activity record –too much activity causes fuse fatigue
TEST won't work	<ul style="list-style-type: none"> • Check DC bus level – too high causes no test • Check blown fuse LED during test – If ON check stage fuses • Check 3460C1 J1 TIME OUT jumper to be OFF • Check test input to 3460C1 • If OK replace 3460C1
Voltage fluctuates during TEST mode	<ul style="list-style-type: none"> • Check threshold and test boost level settings. Over-voltage shutdown can occur if settings are too high on 460V systems, causing an oscillation and low voltage reading • Lower threshold level and retry
Stays in TEST mode	<ul style="list-style-type: none"> • Replace 3460C1
Pre-charge overheated	<ul style="list-style-type: none"> • Check DC bus ripple voltage. Too much ripple can cause PTCRs to overheat <ul style="list-style-type: none"> ▪ Add parallel pre-charge PTCRs ▪ Change series pre-charge resistance ▪ Add fan to cool PTCRs ▪ Add isolated bias supply • Pre-charge can only be done 3 consecutive times before overheating can occur
No UV on DP18	<ul style="list-style-type: none"> • Check input battery voltage level <ul style="list-style-type: none"> ▪ If battery voltage level is sufficient, this is normal • Check battery disconnect • Re-calibrate M3528M2 UV level to meet system needs • If calibration not possible replace M3528M2
Constant UV on DP18	<ul style="list-style-type: none"> • Check input battery voltage level • Check fuses if input is zero • Re-calibrate M3528M2 UV level to meet system needs • If calibration not possible replace M3528M2

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6. ENGINEERING DATA

6.1. RATINGS TABLES

Table 6-1: 4 Minute kW Ratings Table

SYSTEM VOLTAGE RATING CODE	E			H		C
	380VAC SYSTEMS	400VAC SYSTEMS	415VAC SYSTEMS	433VAC SYSTEMS	460VAC SYSTEMS	575VAC SYSTEMS
43	21	22	23	24	25	31
85	41	43	45	47	50	62
130	62	65	67	70	75	95
170	83	87	90	94	100	125
255	125	130	135	141	150	187
340	165	175	180	188	200	<i>N/A</i>
460	225	234	243	254	270	337
610	297	306	324	338	360	<i>N/A</i>
690	338	351	365	381	405	505
920	446	459	486	508	540	673
1150	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	842
1225	594	612	648	677	720	<i>N/A</i>
1375	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	1010
1530	743	765	810	846	900	<i>N/A</i>
1835	891	918	972	1016	1080	<i>N/A</i>

Table 6-2: 15 Minute kW Ratings Table

SYSTEM VOLTAGE RATING CODE	E			H		C
	380VAC SYSTEMS	400VAC SYSTEMS	415VAC SYSTEMS	433VAC SYSTEMS	460VAC SYSTEMS	575VAC SYSTEMS
22	10	11	11	12	12.5	16
43	21	22	23	24	25	32
65	31	32	34	35	38	47
85	41	43	45	47	50	62
130	62	65	67	70	75	95
170	83	87	90	94	100	125
230	112	117	122	127	135	168
305	149	156	162	169	180	<i>N/A</i>
345	167	176	182	190	202	252
460	223	235	244	254	270	337
575	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	421
613	297	313	325	339	360	450
690	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	505
765	372	391	406	423	450	<i>N/A</i>
918	446	470	487	508	540	<i>N/A</i>

Table 6-3: Model Specifications

DC BUS CURRENT ¹	BACKPLATE SIZE	BOOST CIRCUIT CONFIGURATION	BOOST CIRCUIT FUSE RATING	RECOMMENDED FUSE RATING ²	
				BATTERY INPUT	DC BUS OUTPUT
43A	R10	1-Stage	100A	70A	50A
85A	R10	1-Stage	125A	125A	100A
127A	R9	2-Stage	125A	200A	150A
170A	R9	2-Stage	125A	250A	175A
255A	R2	4-Stage	125A	400A	300A
340A	R2	4-Stage	125A	500A	350A

¹ Please note that the DC Bus Current ratings listed above indicate the TOTAL DC Bus current that can safely be handled by the Battery Regulator Ride-Thru unit. While each DC output from the Ride-Thru is capable of handling this load, for Ride-Thru units with multiple outputs, the combined load of all outputs must not exceed this rating.

² Fuses recommended for use with S3460BR Ride-Thru systems should be Gould-Shawmut A70QS series, Buss FWP series, or equivalent semiconductor fuses.

Table 6-4: Battery Bank Typical Values

SYSTEM AC VOLTAGE	208	230	380	400	415	433	460
Battery Qty	18	20	34	35	36	38	40
Nominal Voltage	216	240	408	420	432	456	480
Full or Float Voltage	243	270	459	473	486	513	540
Equalize Voltage	249	277	470	484	498	526	554
Discharged Voltage	180	200	340	350	360	380	400

6.2. WATT LOSS (INACTIVE POWER CONSUMPTION)

- <100 Watts for units rated at 170ADC bus load or less.
- <200 Watts for units rated at greater than 170ADC bus load.
- All S3460BR models are 93% efficient or better @ full load.

6.3. BATTERY SELECTION DATA

When selecting a battery string for use with the Model S3460BR Battery Regulator Ride-Thru System, please note that the battery string voltage must remain within a certain range for proper system operation.

If batteries for the S3460BR system are obtained locally, refer to Table 6-4 and Figures 6-1 thru 6-8 for aid in battery selection, as well as the battery selection guide in Section 7 of this manual.

Figure 6-1: Power Curves For 12kW to 25kW Systems

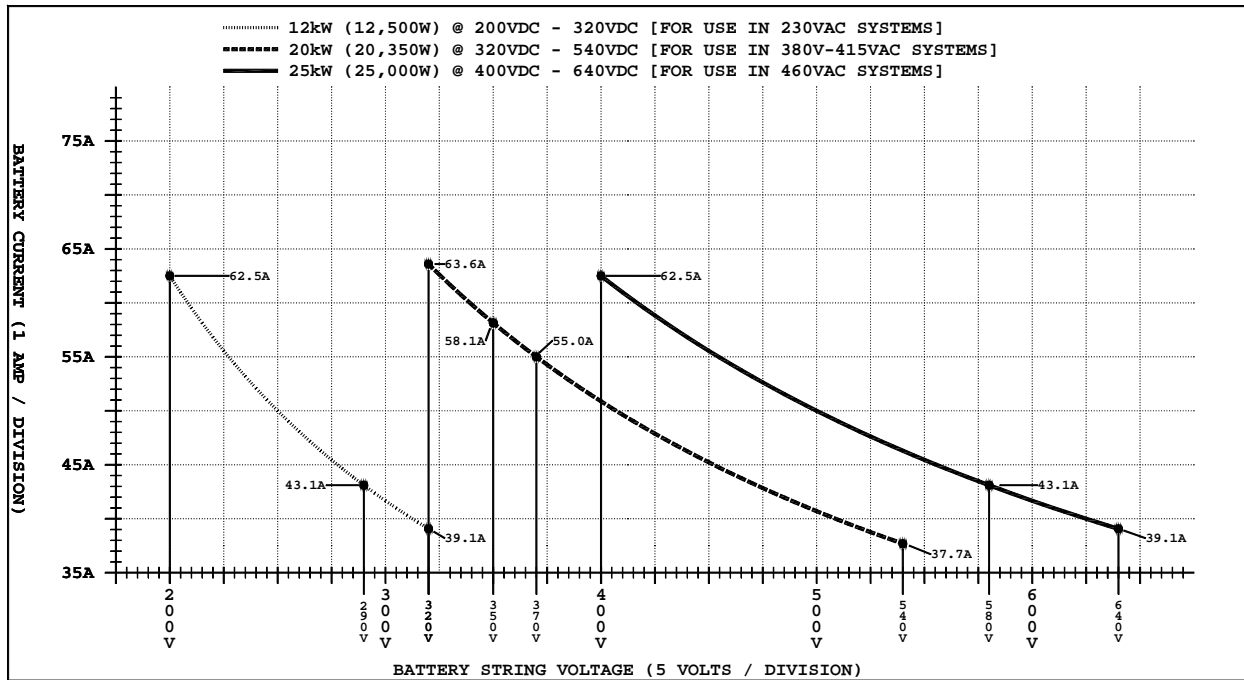


Figure 6-2: Power Curves For 18kW to 37kW Systems

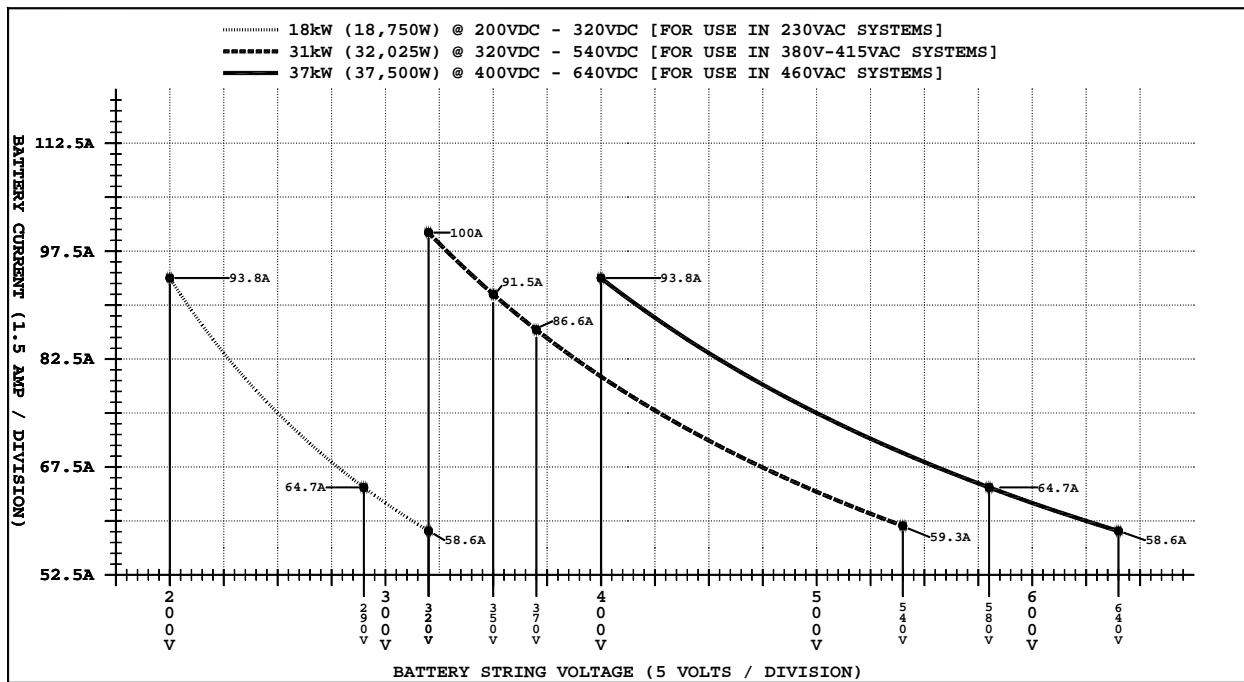


Figure 6-3: Power Curves For 25kW to 50kW Systems

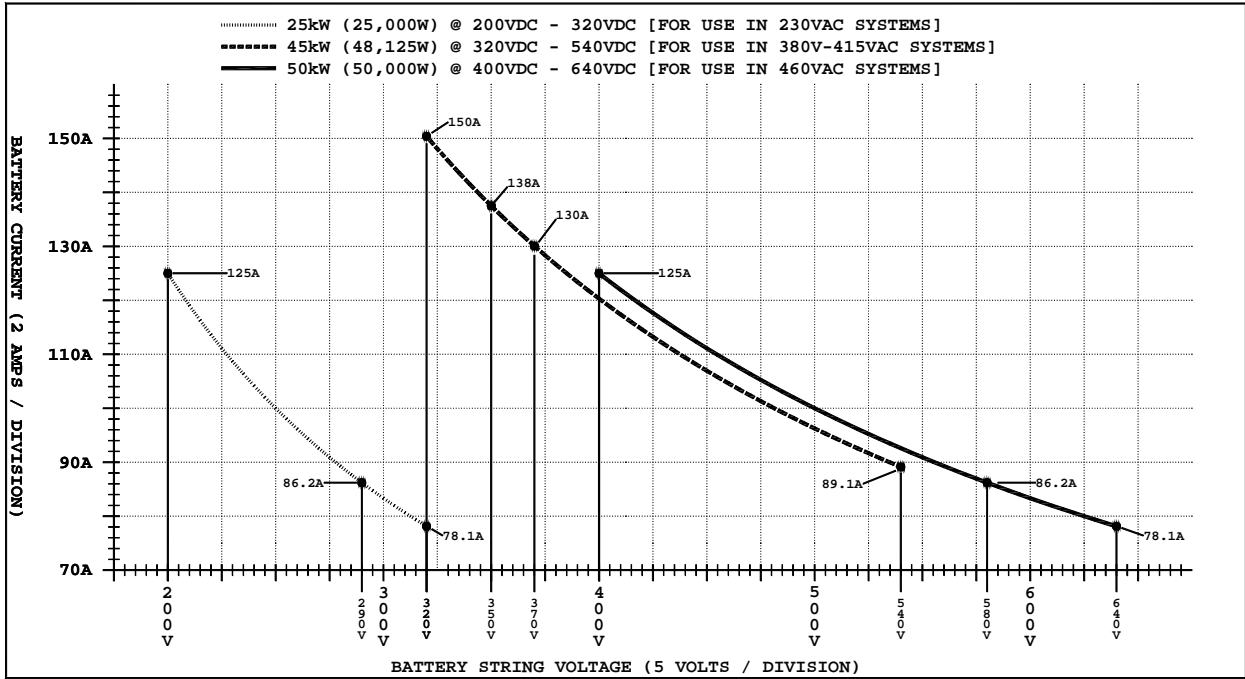


Figure 6-4: Power Curves For 37kW to 75kW Systems

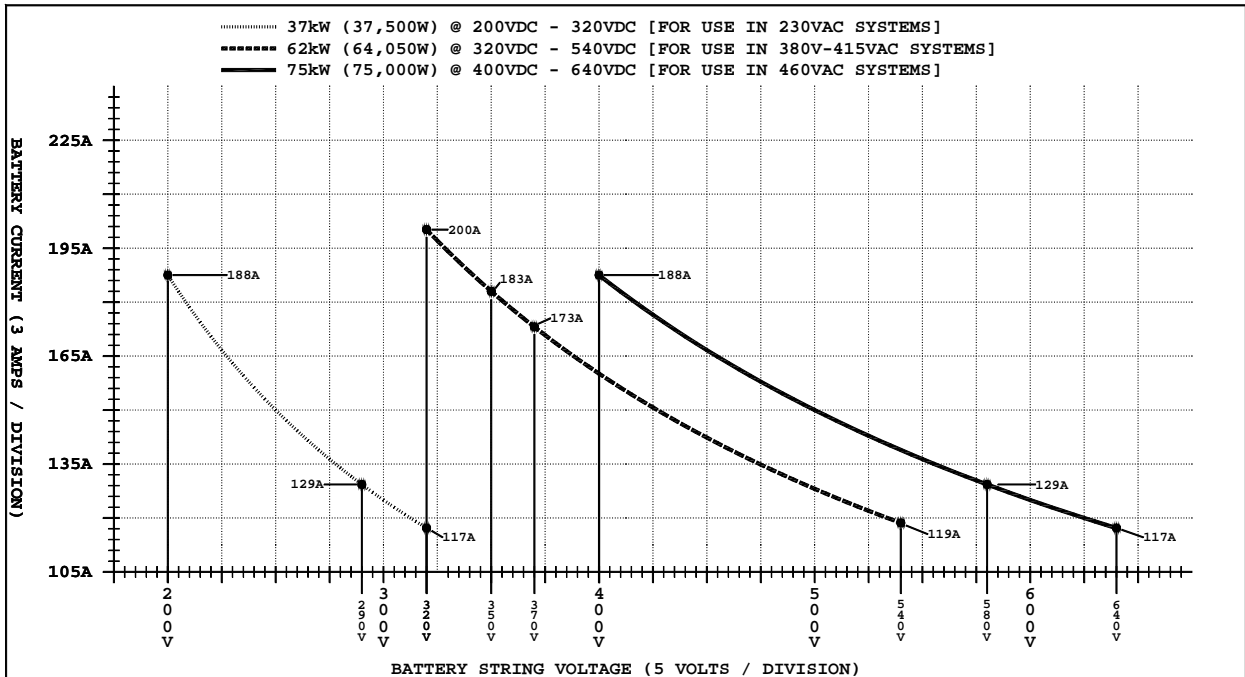


Figure 6-5: Power Curves For 50kW to 100kW Systems

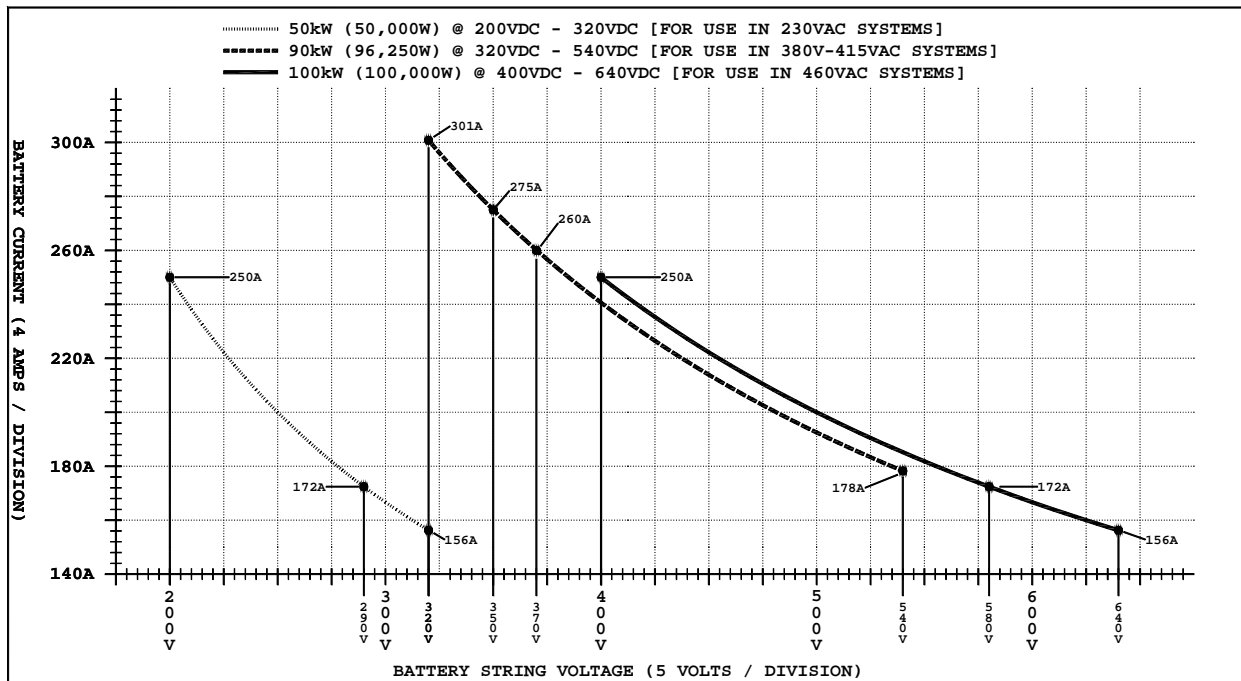


Figure 6-6: Power Curves For 75kW to 150kW Systems

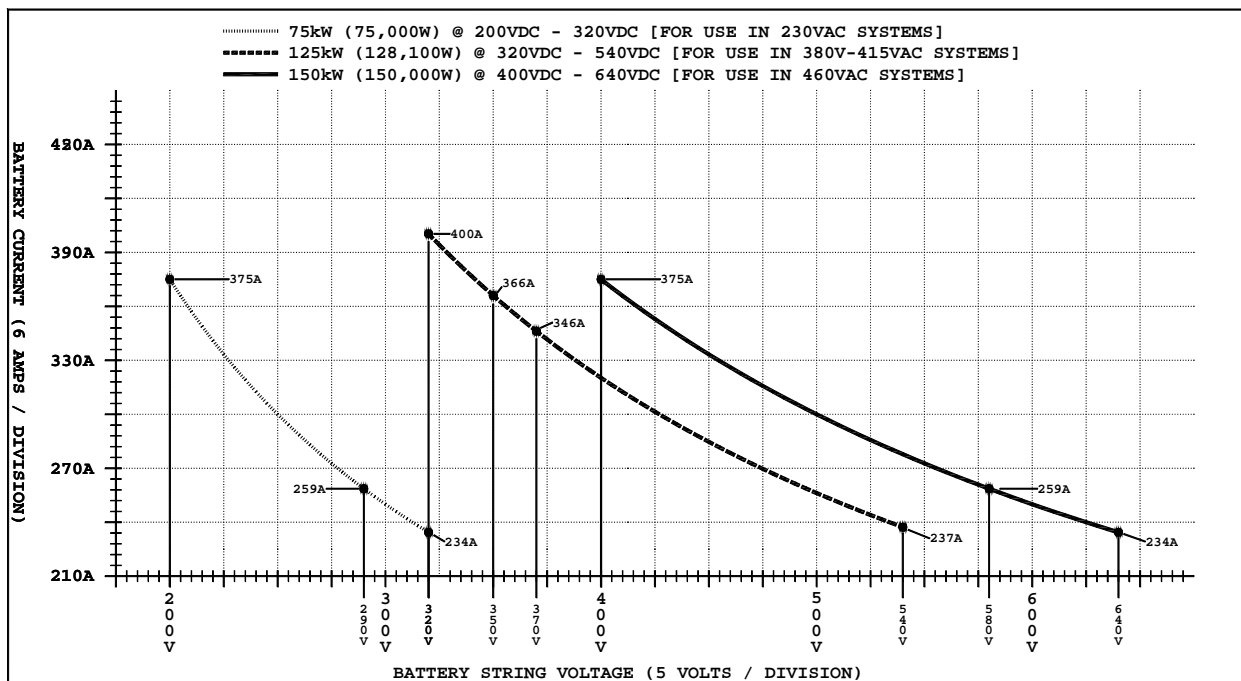


Figure 6-7: Power Curves For 100kW to 200kW Systems

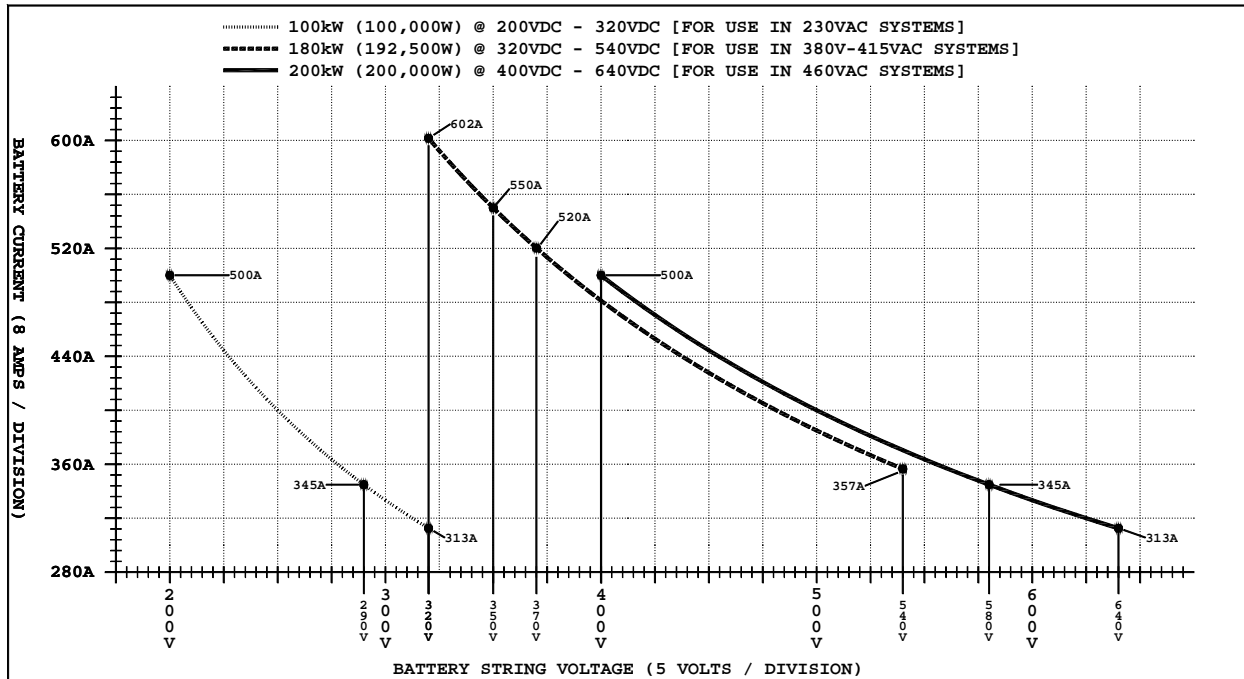
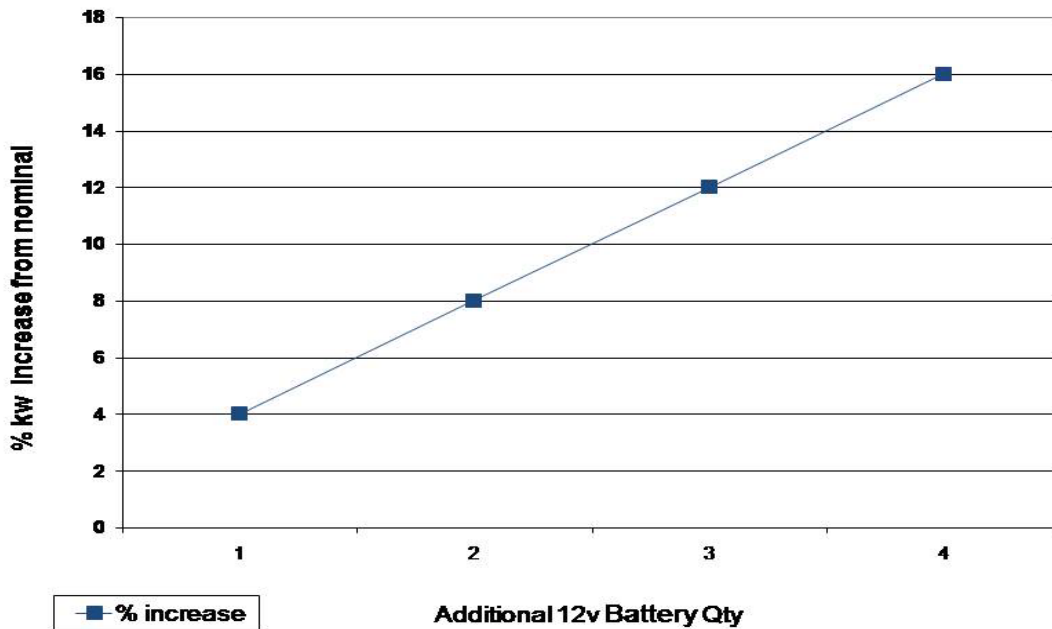


Figure 6-8: Typical Extended Ratings



6.4. FUSE/CIRCUIT BREAKER SIZING AND RATING

Fuses recommended for use with S3460BR Battery Regulator Ride-Thru systems should be Gould-Shawmut A70QS series, Buss FWP series, or equivalent semiconductor fuses. See Table 6-3 for fuse size and ratings.

The Battery Regulator Ride-Thru Module provides internal boost circuit fusing only. All input and output fusing and power disconnects are provided by the customer.

6.5. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-9: Single Cabinet Dimensional Outline



Table 6-5: D40 Series Single Cabinet Dimensions

CHASSIS CODE	HEIGHT (H)	WIDTH (W)	DEPTH (D)	SYSTEM KW 4 MINUTE RATING	SYSTEM KW 15 MINUTE RATING
D40	72	28	18	22 – 62kW	12 – 25kW
D41	72	34	18	65 – 100kW	25 – 50kW
D42	72	40	18	130 – 200kW	50 – 100kW

Figure 6-10: Dual Cabinet Dimensional Outline

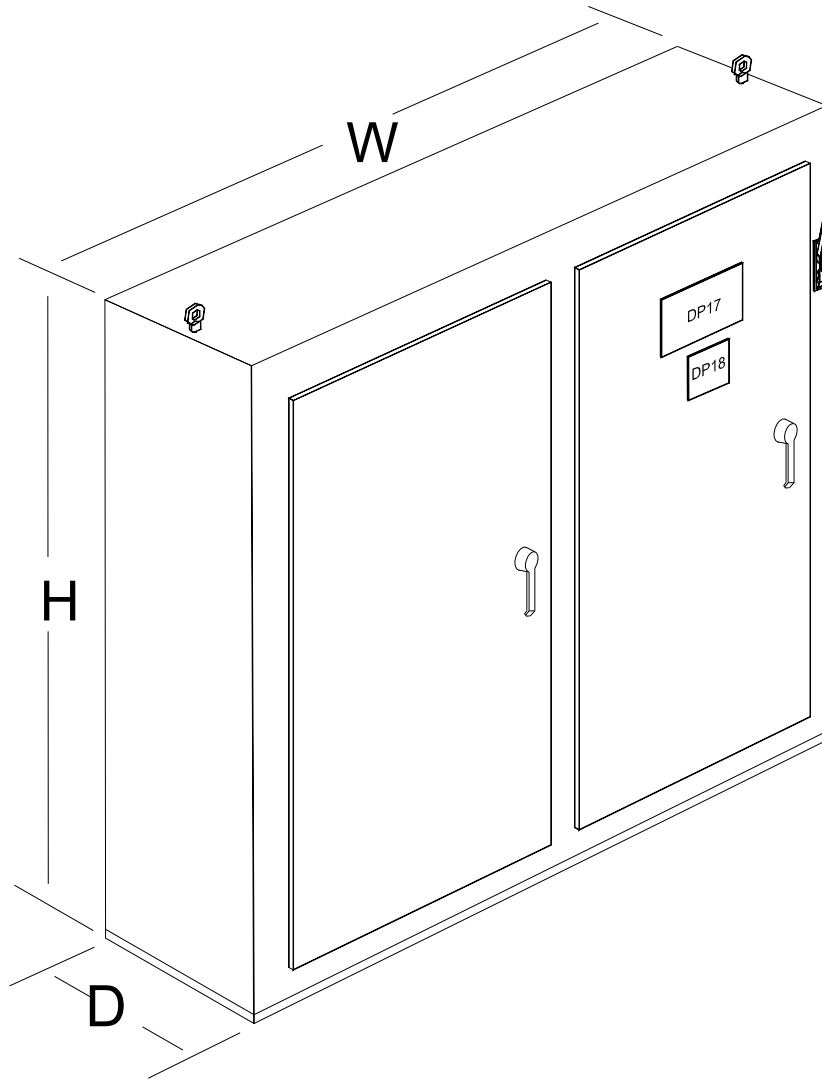


Table 6-6: D50 Series Dual Cabinet Dimensions

CHASSIS CODE	HEIGHT (H)	WIDTH (W)	DEPTH (D)	SYSTEM KW 4 MINUTE RATING	SYSTEM KW 15 MINUTE RATING
D51	72	66	18	234 – 360kW	135 – 180kW
D52	72	78	18	351 – 540kW	200 – 270kW

6.6. BLOCK DIAGRAMS

Figure 6-11: Basic 100% Outage Ride-Thru System

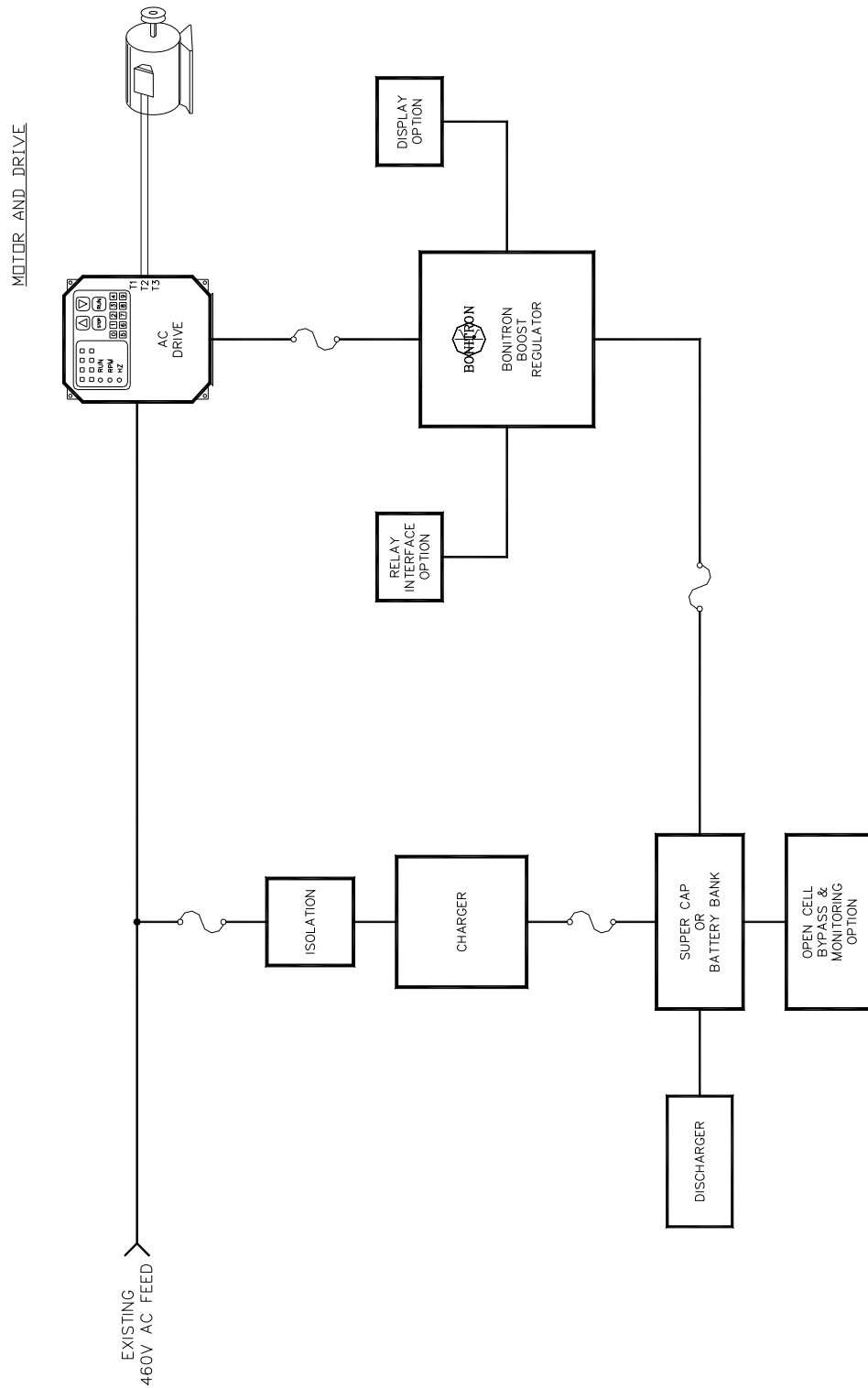
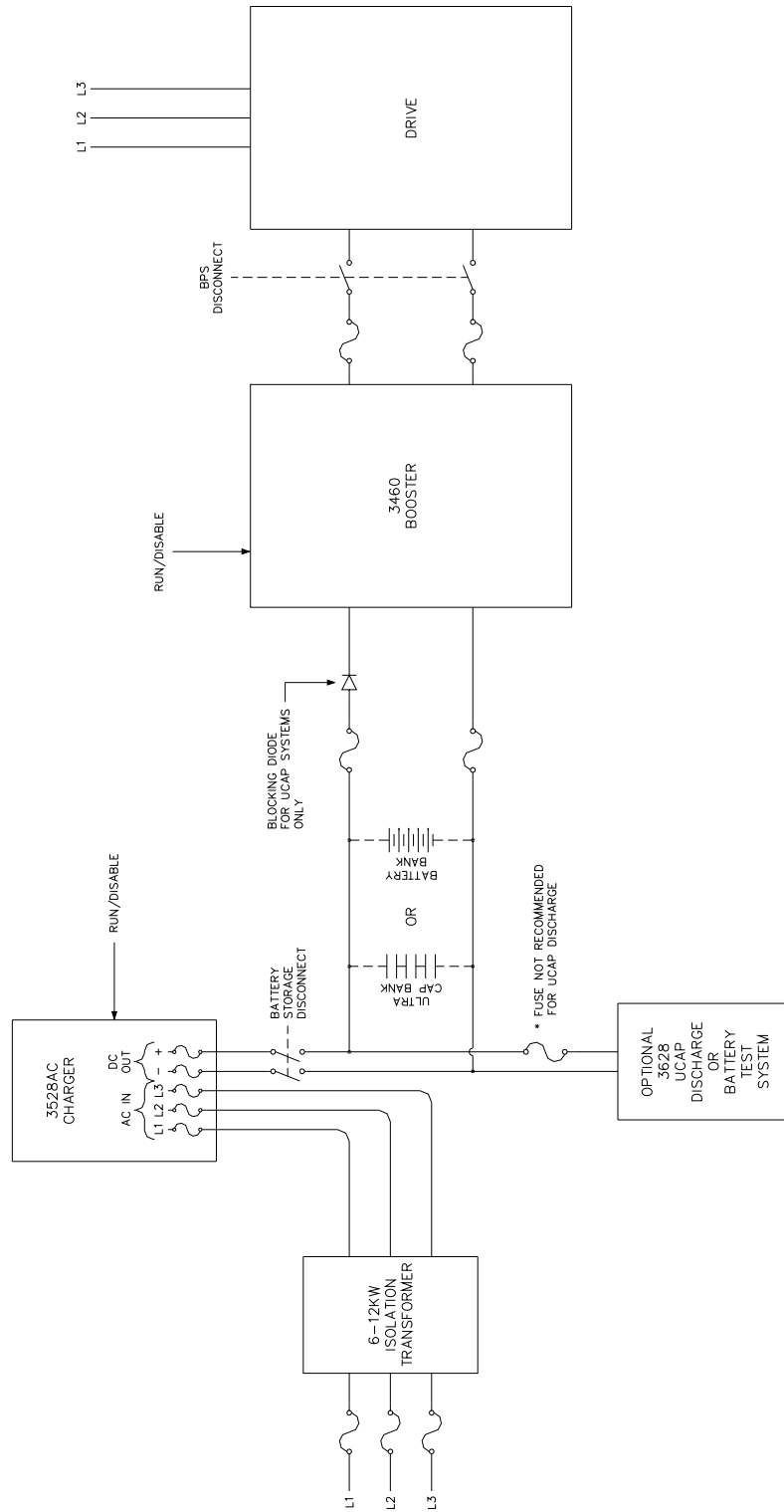
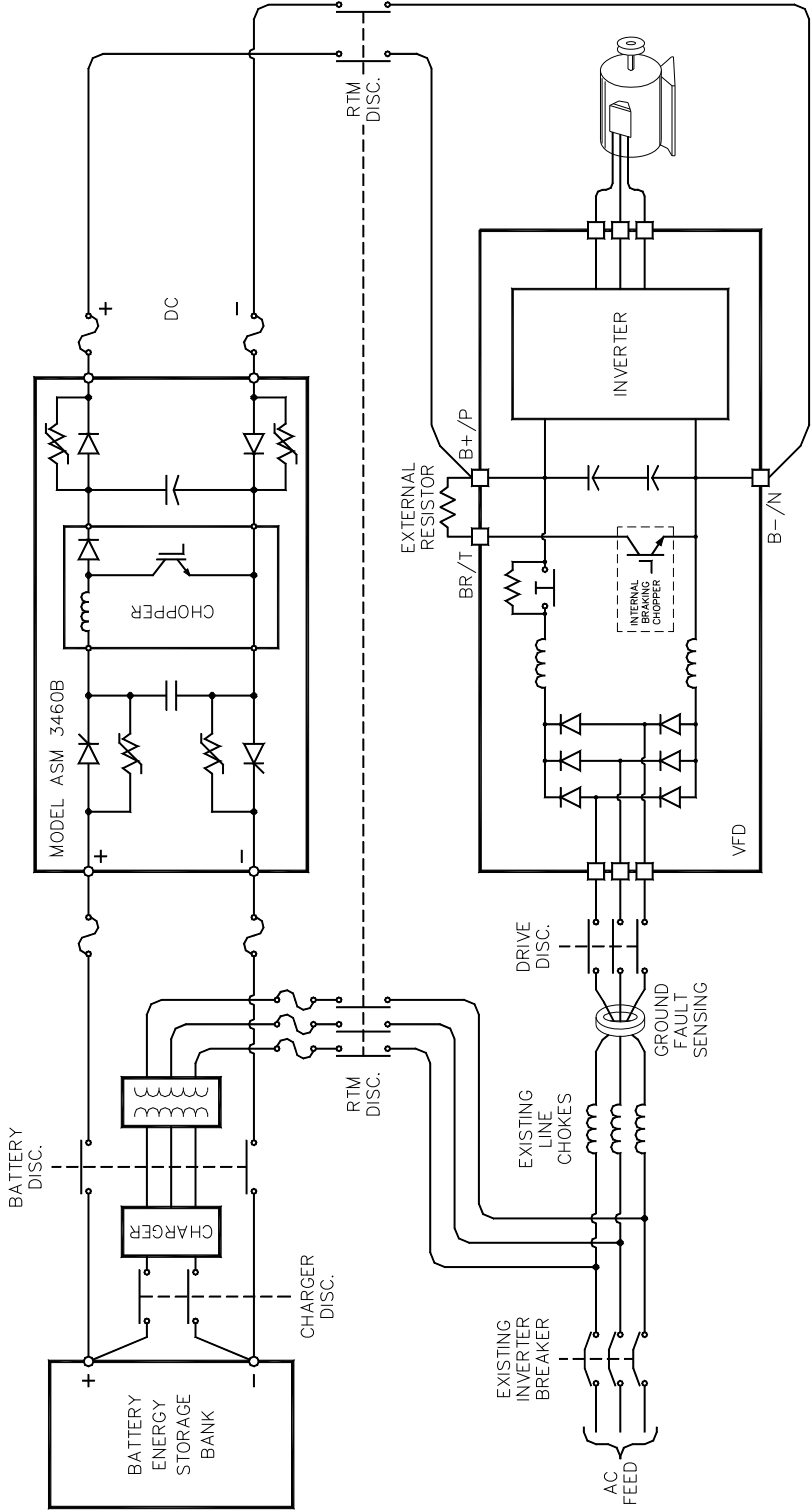


Figure 6-12: Typical S3460BR System Interconnection



6.7. SUPPLEMENTAL DRAWINGS

Figure 6-13: Schematic of the 100% Outage Ride-Thru System



6.8. RECOMMENDED SPARE PARTS

The part numbers listed on the next page represent a listing of all major components and the quantities of each used in various Bonitron Model S3460BR Battery Regulator Ride-Thru Systems.

This list is intended for use as a reference if ordering spare parts for the Ride-thru modules becomes necessary. Please remember to refer to the complete Bonitron part number when ordering parts.

Each printed circuit board has a serial sticker (i.e. 3460C1DJ #125). Please refer to Table 6-7 below. Include every character when ordering spare PCBs – this will help ensure a proper order.

Parts should be ordered by the responsible party through your local distributor or system integrator.

Table 6-7: Example of PCB Serial Sticker

MODEL #	FUNCTION	LAYOUT VERSION	COMPONENT VERSION	SERIAL NUMBER
3460	C1	D	J	125

Table 6-8: Spare Parts List

<u>SPARE PARTS LIST</u>		85 amp	125 amp	170 amp	255 amp	340 amp
<u>Part Number</u>	<u>Part Description</u>	<u>Quantity Per Module</u>				
M3460B-E043-240-R10	350-485V , 43kW Boost Module	1				
M3460B-E062-240-R9	350-485V , 62kW Boost Module		1			
M3460B-E087-240-R9	350-485V , 87kW Boost Module			1		
M3460B-E135-240-R2	350-485V , 135kW Boost Module				1	
M3460B-E175-240-R2	350-485V , 175kW Boost Module					1
M3460B-H050-240-R10	400-585V , 50kW Boost Module	1				
M3460B-H075-240-R9	400-585V , 75kW Boost Module		1			
M3460B-H100-240-R9	400-585V , 100kW Boost Module			1		
M3460B-H150-240-R2	400-585V , 150kW Boost Module				1	
M3460B-H200-240-R2	400-585V , 200kW Boost Module					1
M3528AC-E010-A5	473VDC 10 amp Charger Module	1	1	1	1	1
M3528AC-H010-A5	540VDC 10 amp Charger Module	1	1	1	1	1
XR ISO-6kVA-480-121	6kVA charging isolation transformer for 460V systems	1	1	1	1	1
XR ISO-5kVA-400-121	5kVA charging isolation transformer for 400V systems	1	1	1	1	1
FN 115	Fan for cabinet cooling	1	1	1	1	1
FN Filter	Filter for cabinet fan	2	2	2	2	2
FS CB-2P-225A	2-Pole Rack DC Disconnect (Front Panel Option)	1	1	1	1	1
FS CB-3P-225A	3-Pole Rack AC Disconnect (Front Panel Option)	1	1	1	1	1
FS CB-A1X1PK	AC Disconnect Aux. Contact	1	1	1	1	1
FS CB-SNT1RP08K	AC/DC Disconnect Shunt Coil (Rack Option)	2	2	2	2	2
FS FNQ5	Fuse For Cabinet Fan	1	1	1	1	1
FS FWP-80A	Buss FWP Type 80A Fuse	2	-	-	-	-
FS FWP-125A	Buss FWP Type 125A Fuse	2	2	-	-	-
FS FWP-175A	Buss FWP Type 175A Fuse (Fuse Option)	-	-	2	-	-
FS FWP-200A	Buss FWP Type 200A Fuse (Fuse Option)	-	2	-	-	-
FS FWP-250A	Buss FWP Type 250A Fuse (Fuse Option)	-	-	2	2	-
FS A70QS350-4	Gould A70QS Type 350A Semicon Fuse (Fuse Option)	-	-	-	-	2
FS FWP-400A	Buss FWP Type 400A Fuse (Fuse Option)	-	-	-	2	-
FS A70QS500-4	Gould A70QS Type 500A Semicon Fuse (Fuse Option)	-	-	-	-	2
IST CTR-03L	LCD Counter/Totalizer (Front Panel Option)	2	2	2	2	2
1ST METER-BL3.5-400A	0-400ADC Current Meter	-	-	-	-	1
IST METER-48	0-300ADC Current Meter	-	-	1	1	-
IST METER-32	0-200ADC Current Meter	1	1	-	-	-
IST METER-49	Yoko 3.5" : 0-1000 VDC, 0-1 Ma In	1	1	1	1	1
IST METR25-750V	YOKOGAWA 2.5" METER: 0-750VDC (0-1 Ma INPUT)	1	1	1	1	1
IST METR25-750V-H	HOYT 5025: 0-750 VDC 0-1 Ma - With 0.96" Terminals	1	1	1	1	1
SW PB-8121	Test Push-Button Switch	1	1	1	1	1

7. APPENDICES

7.1. DRIVE RIDE-THRU SELECTION GUIDE

Bonitron manufactures several different DRT models for specific applications. The following is a general guideline for applying the appropriate model for best cost effectiveness. Short term outage is defined as less than 2 seconds, and long term outage is defined as more than 2 seconds.

1. Fractional to 3hp, 50% sag or 100% short term outage should consider M3534EC.
2. Fractional to 3hp, 100% long term outage should consider S3534BR.
3. 3hp to 67hp 50% sag should consider M3534R.
4. 3hp to 15hp 100% short term outage should consider S3534CR.
5. 15hp to 67hp 100% short term outage should consider S3534UR.
6. 3hp to 67hp 100% long term outage should consider S3534BR.
7. 75hp to 2000hp 50% sag should consider M3460R.
8. 75hp to 2000hp 100% short term outage should consider S3460UR.
9. 75hp to 2000hp 100% long term outage should consider S3460BR.

7.2. INSTALLATION CONSIDERATIONS FOR DRIVE RIDE-THRU SYSTEMS

The following should be considered when installing a Bonitron Ride-Thru Module:

1. Inverter logic voltage must be "backed up".
 - Most new Inverters derive logic supply from DC bus.
 - Install UPS on circuits with AC feed.
2. Any control or Interlock relays must be backed-up.
 - Test Relays at half voltage for dropout.
 - Use DC relays on logic supply.
 - Install UPS on circuits with AC feed.
3. Determine the maximum motor voltage needed.
 - To ensure Threshold level is sufficient to supply motor.
 - Most inverters automatically compensate RMS to motor.
4. Determine battery bank voltage.
 - See charts in manual for proper sizing.
5. Determine Charger current ratings. Size according to:
 - Charge - recharge time specifications.
 - Battery bank capacity.
 - Joule loss during full load full time outage.
6. Verify actual AC line voltage and inverter DC bus level.
 - To ensure Threshold level is set – 10% of nominal DC bus level.
 - To ensure valleys of ripple do not cause unwanted activity.
7. Determine Inverter low bus trip point.
 - To ensure Threshold level is above inverter dropout.
8. Determine Inverter high bus trip point.
 - To ensure Test level will not over voltage inverter.
9. Cabinet airflow:
 - M3460B units are 93% efficient or better. Extra cooling may be required for full 4 minute outage.
 - M3528 Charger and Transformer combination is 93% efficient or better and will run for several hours during a full recharge cycle.

10. Inverter ground fault circuits:
 - Ensure battery charger is isolated.
11. Electrical safety:
 - Use shunt trip interlock between Inverter and Ride-Thru to keep battery bank from supplying power during inverter maintenance.
 - Place labels on cabinet door stating all power sources to cabinet.
12. DCS monitoring of status signals:
 - Dry fault contact option available.
13. Wiring:
 - IR drop of interconnection wiring should be considered for long wire runs.
14. Local wiring codes.

7.3. APPLICATION NOTES FOR S3460BR SYSTEMS

When selecting a Battery Regulator Ride-Thru Module, be certain to choose a module with a power rating (kW) equal to or exceeding that of the drive(s) being supplied by the module.

1. A disconnect should be installed between the drive DC bus and the booster DC output for maintenance purposes.
2. Fusing should be installed between the drive DC bus and the booster DC output. A70Q series or FWP series 700V are OK.
3. A disconnect should be installed between the charger and the battery bank. (AC and DC fusing is included inside charger box)
4. Fusing should be installed in the isolation transformer primary circuit. 500V slow blow type.
5. A disconnect should be installed between the battery bank and booster module.
6. Fusing should be installed between the battery bank and the booster input. Semiconductor 600V is OK.
7. Airflow must be supplied to the cabinet housing the booster and charger modules to remove heat during outage and recharge time, and can use thermal temp switch, RTA signal, or power loss to initiate cooling. Standby power losses are less than 300W for booster and charger and transformer. Cooling should continue 12 hours after active cycle starts.
8. The RUN command should be sent through the under-voltage and over-temp contacts on the Bonitron 3460M6 interface board, so that in either case the system will shutdown, preventing damage to the booster or battery bank. Some end users purposely choose to ignore these warnings because the process is the paramount concern.
9. VFD ground fault circuits should be checked. Some VFDs have very sensitive ground faults, and when using external DC input they can be tripped. Be sure it can be disabled if a problem should occur, and be ready to add a ground fault detection somewhere upstream of the drive if that safety aspect is essential to the application.

7.4. BATTERY SELECTION GUIDE

Use the following steps in conjunction with “Battery Voltage Selection Curves” to aid in selecting batteries for use with Bonitron Drive Ride Thru Systems. Table 1 below shows typical battery voltage levels for various system AC voltages.

Table 7-1: Typical Battery Voltage Levels

SYSTEM AC VOLTAGE	BATTERY SERIES QTY	NOMINAL DC VOLTAGE	DISCHARGED VOLTAGE	CHARGING VOLTAGE	EQUALIZE VOLTAGE
208	18	216	180	243	249
230	20	240	200	270	277
380	34	408	340	459	470
400	35	420	350	473	484
415	36	432	360	486	498
433	38	456	380	513	526
460	40	480	400	540	554

To choose batteries, follow these steps. We will use a 460VAC system rated for 200W, in need of 4 minutes of ride through time for our example. Use Table 7-1 for data.

1. Find max current at min DC battery voltage for the given kW rating of the system.
 - a) Ex: 460VAC 200kW system, ÷ 400VDC min DC input = 500 amps.

** Battery bank must be capable of 500 amps.
2. Next choose enough series batteries to get the minimum voltage when discharged. Use this to ensure the battery bank has enough voltage for the boost regulator module to work from. (See Table 7-1 for min DC voltages.)
 - a) Battery life is dependent on discharge voltage. The lower they are allowed to discharge, the shorter the life.
 - i. We use 1.67 per cell as a minimum, which equals 10V per battery.

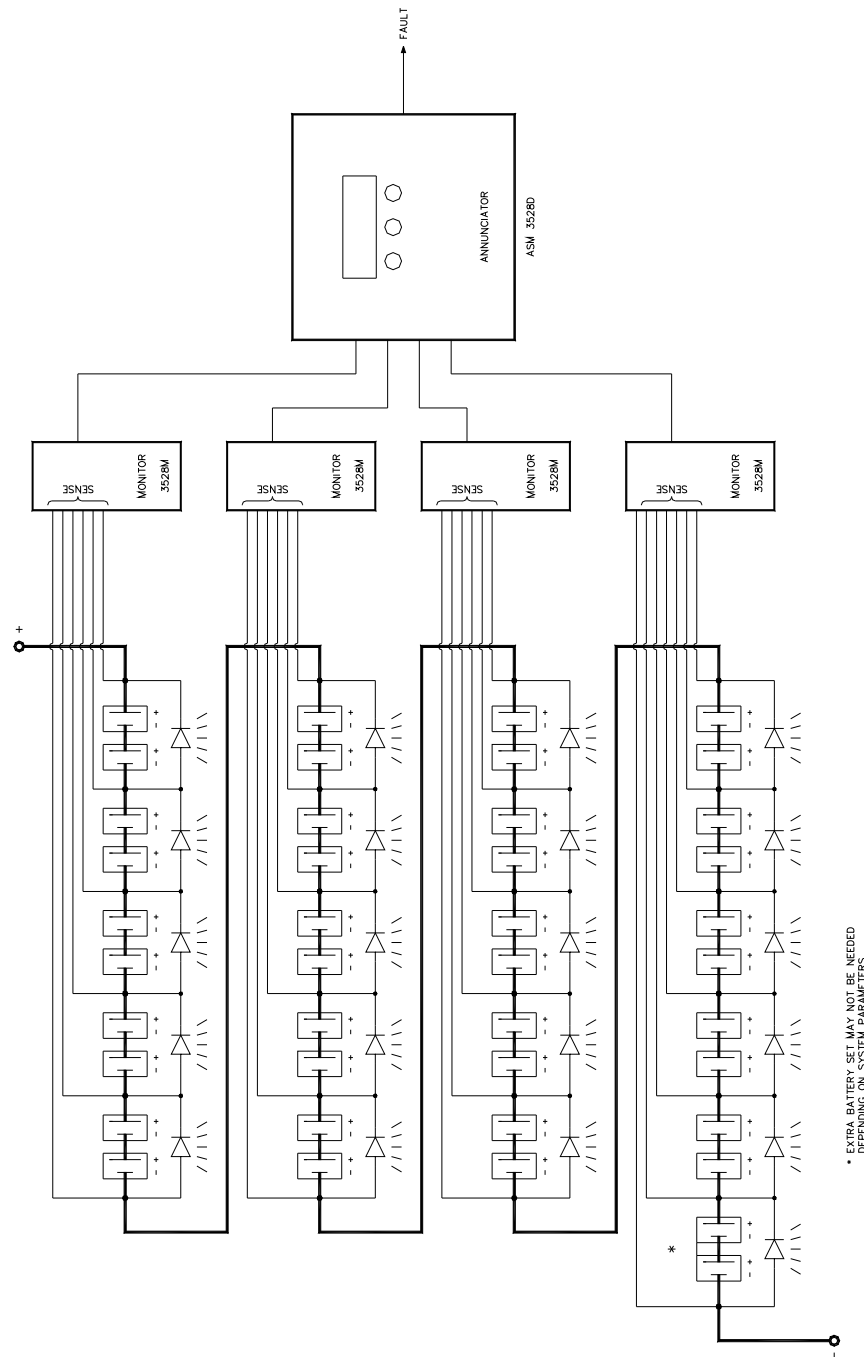
** 400VDC minimum ÷ 10V discharge level = 40 series batteries.

 - b) NOTE: Charging voltage should not exceed the threshold voltage of the boosting system. (Typically 585VDC for 460VAC drive system.)
 - i. Typical recommended charging voltage is 1.125x battery voltage.
 - ii. 40batt x 12V x 1.125 = 540VDC.
3. Choose a battery with enough watts per cell for the time you need.
 - a) Add up all the power consumption to be sure the batteries have enough storage.
 - i. Ensure drive losses have been accounted for (95% efficient).
 - ii. Ensure booster losses have been accounted for (95% efficient).
 - iii. Add 15% in time or kW for headroom.
 - b) Battery specs usually show watts per cell at discharge rates.
 - i. Watts per cell usually refers to the 2V cell inside the battery.
 - ii. Each 12V battery has 6 cells.
 - iii. Available watts per cell increases with a longer discharge time.
 - c) Ex: 200kW for 4 minutes (200W ÷ .95eff ÷ .95eff + 15% headroom = 254kW) x 240 sec = 61 mega joules).
 - i. 40 series batteries x 6 cells each = 240 cells total.
 - ii. 61 MJ ÷ 240 cells, ÷ 240 sec = 1061 watts per cell.

- 1061W per cell is very high for a battery so two parallel strings will likely be needed.
- iii. $1061Wpc \div 2 \text{ strings} = 530 \text{ watts per cell for each string.}$

For this application you will need 80 batteries rated for 250 amps that can deliver 530W per cell for 4 minutes, with an end voltage of 1.67V per cell.

Figure 7-1: 480VDC Battery Bypass System



7.4.1. TYPICAL DRIVE BUS VOLTAGE

Figure 7-2: Typical Drive Bus Voltage for 400VAC Systems (VDC)

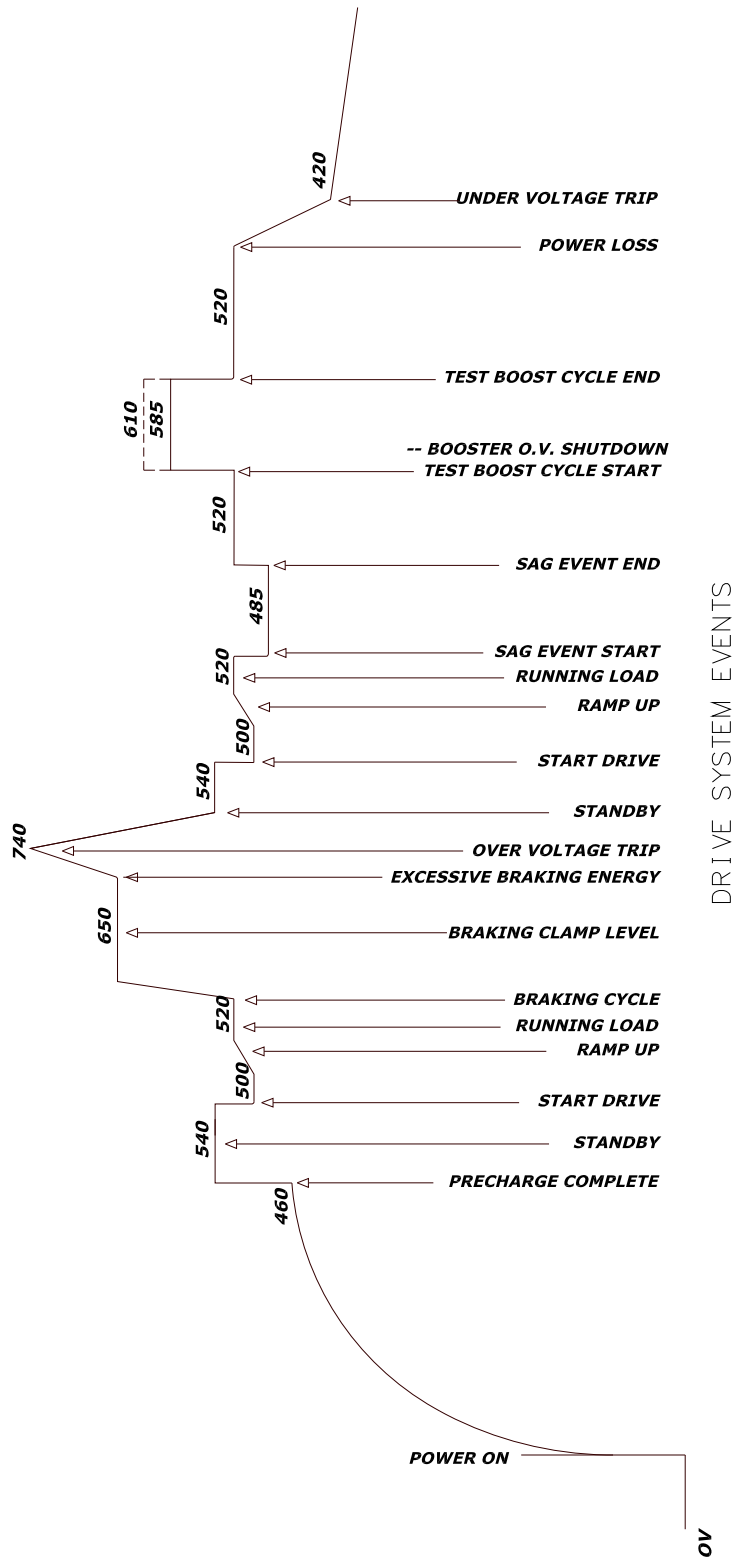


Figure 7-3: Typical Drive Bus Voltage for 460VAC Systems (VDC)

