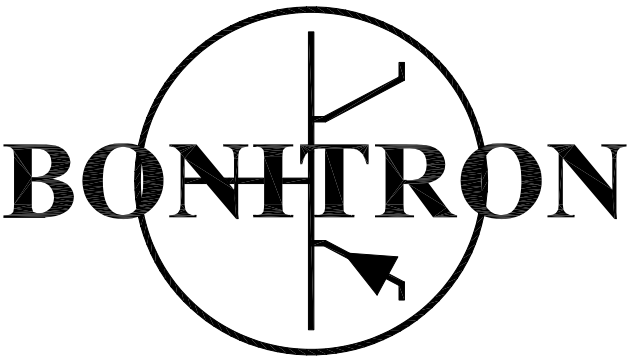


Model S3534BR

Battery Regulator Ride-Thru Cabinet Systems

Customer Reference Manual

TEL. (615) 244-2825 • www.bonitron.com • FAX (615) 244-2833

Bonitron, Inc.

An Industry Leader in AC Drive Systems and Industrial Electronics

OUR COMPANY

Bonitron is an international supplier of power controls designed to improve the performance and reliability of electronic systems and variable frequency drives. Located in Nashville, Tennessee, and founded in 1962, Bonitron has gained a reputation for designing and manufacturing products 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.

Bonitron AC drive modules are available to provide Undervoltage, Overvoltage, Line Side, Load Side, Maintenance, Power Quality, and Green / Sustainability solutions. These products are compatible with the drives of all major manufacturers and have become the standard in many industries including semiconductor, oil, and fiber.

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

1. INTRODUCTION 1
1.1. Who should use this Manual 1
1.2. Purpose and Scope 1
1.3. Manual Version and Change Record 1
Figure 1-1: S3534BR H024-D41 with DD3 1

2. PRODUCT DESCRIPTION 2
2.1. Related Products 2
2.2. Part Number Breakdown 3
Figure 2-1: Example of Part Number Breakdown 3
Table 2-1: System Voltage Rating Codes 3
Table 2-2: Cabinet Information 4
Table 2-3: Special Option Codes 4
2.3. General Specifications 5
Table 2-4: General Specifications Chart 5
2.4. General Precautions and Safety Warnings 6
2.4.1. VRLA Warnings and Precautions 6
2.4.2. Model M3534B Warnings and Precautions 10

3. INSTALLING THE S3534BR RIDE-THRU MODULE 11
3.1. Environment / Site Selection 11
3.2. Product Inspection / Unpacking 11
3.3. Mounting 11
Figure 3-1: Mounting Instructions for D4* Series Cabinets 12
3.4. Wiring the S3534BR Ride-Thru Cabinet 13
3.4.1. Power Wiring 13
Figure 3-2: Field Connections at Main Disconnect Switch 13
Table 3-1: Power Wiring Field Connections 14
3.4.2. Control Wiring 14
Figure 3-3: Control Connections at TS1 for DPx Series 14
Table 3-2: Control & Status Field Wiring Connections for DPx Series Displays 14
Figure 3-4: Control Connections for DD3 Series on ASM 3660I2-RM178 15
Figure 3-5: Status Connections for DD3 Series 15
Table 3-3: Status and Control and Staus Field Wiring Connections for DD3 Displays 16
3.5. Typical Configurations 16
3.5.1. System Wiring - DRT To Drive Interconnections 16
Figure 3-6: DRT Ride-Thru System Configuration 5 16
Figure 3-7: S3534BR Ride-Thru System Configuration 12 17
Figure 3-8: Typical S3534BR 50kW and Below Interconnection with Drive System 18
Figure 3-9: Control and Status with DD3 19

4. OPERATION 21
4.1. Functional Description 21
4.1.1. Operation During Outage Event 21
4.1.2. Continuous Operation 21
4.2. Features 22
4.2.1. Terminal Strip I/O 22
Table 4-1: Fault Logic Table 22
Table 4-2: Manual Control with Enable Signal 23
Table 4-3: Manual Control with Disable Signal 24
Table 4-4: Automatic Control with Enable Signal 24
Table 4-5: Automatic Control with Disable Signal 25

4.2.2. Displays 25
Table 4-6: Diagnostic Display Panel Configurations 25
Figure 4-1: Display Panels 26
Table 4-7: System Status Display Reference Tables 29
Table 4-8: Automatic Shutdown Truth Table 31
4.3. S3534BR Ride-Thru Field Start-up Procedure 33
4.3.1. Initializing the battery modules 33
4.3.2. Powering up from internal battery bank 34
4.3.3. Powering up from Disconnect Switch 36
4.4. Operational Adjustments 37
4.4.1. Threshold Voltage Adjustment Procedure for Model M3534 Ride-Thru Modules 37
Table 4-9: Factory Setpoints for Threshold and Test Boost Voltages 37
4.4.2. Determining Threshold Voltage Setpoint 38
4.5. Calibration 38

5. MAINTENANCE AND TROUBLESHOOTING 39
5.1. Periodic testing 39
5.1.1. Periodic Maintenance Procedures for S3534BR with Diagnostic Display Options 39
5.2. Maintenance items 40
5.3. Maintenance Records 41
Table 5-1: Maintenance record 41
5.3.1. Capacitor Replacement Recommendations 42
5.3.2. Battery Replacement Procedure 43
Figure 5-1: Battery Module Plug Disconnected 44
Figure 5-2: Battery Module Plug Connected 44
5.4. Troubleshooting 45
Table 5-2: Troubleshooting Guide 45
5.5. Technical Help – Before you call 46

6. ENGINEERING DATA 47
6.1. Ratings Charts 47
Table 6-1: Model M3534B Ride-Thru Module Ratings @ 60 Sec 47
Table 6-2: Model M3534B Ride-Thru Module Voltage Levels 47
Table 6-3: De-Rating Table 47
Figure 6-1: Extended Ratings Typical for 85 Amp 400VAC Systems 48
Figure 6-2: Extended Ratings Typical for 85 Amp 460VAC Systems 48
Table 6-4: Typical Storage Bank Configurations 48
Figure 6-3: Outage without Ride-Thru 49
Figure 6-4: Outage with Ride-Thru 49
Figure 6-5: Drive System Power Outage with Batteries and Booster 50
6.2. Watt loss 50
6.3. Certifications 50
6.4. Fuse/Circuit Breaker Sizing and Rating 50
6.4.1. Recommended Input Power Wiring Sizes And Power Source Fusing 50
Table 6-5: Input Power Wiring Sizes and Fusing 50
6.5. Dimensions and Mechanical Drawings 51
Figure 6-6: S3534BR D41 Cabinet Dimensional Outline 51
6.6. Supplemental Drawings 52
6.6.1. Systems with DPxx Display Panels 52
Figure 6-7: S3534BR-H024-020-D41 Wiring 52
Figure 6-8: S3534BR-H024-030-D41-D Wiring (Dual Output) with DPx Display 53
Figure 6-9: S3534BR DP17 & DP18 Wiring 54
Figure 6-10: S3534BR Diagnostic Signal Connections 55

6.6.2. Systems with DD3 Digital Display Panels 56
Figure 6-11: S3534BR-H024-030 DD3 Wiring 56
Figure 6-12: S3534BR-H024-030-D41-with DD3 and 3660I2 Wiring 57
Figure 6-13: S3534BR with DD3 Diagnostic Signal Connections 58
6.7. Recommended Spare parts 59
6.7.1. Spare Parts List 59
Table 6-6: Example of PCB Serial Sticker 59
Table 6-7: Spare Parts List 59

7. APPENDICES 61
7.1. Drive Ride-Thru Selection Guide 61
7.2. Installation Considerations for Drive Ride-Thru Systems 61
7.3. Application Notes for S3534BR Systems 62
7.4. Battery Selection Guide 63
Table 7-1: Typical Battery Voltage Levels 63
7.5. Battery Discharge Rates 64
Figure 7-1: M3528B 120V Battery Bank 64
Figure 7-2: M3528B 480V Battery Bank for 460VAC Systems 64
Table 7-2: Battery Discharge Table 65
7.6. Diode Sharing with a Bonitron Ride-Thru 66
Figure 7-3: Diode Sharing (Not) Recommended With Individual Line Chokes 67
Figure 7-4: Diode Sharing (Not) Recommended With (Non) Equivalent Drives 67
7.7. Typical Drive Bus Voltage Levels 68
Figure 7-5: Typical Drive Bus Voltage Levels for 400VAC Systems (VDC) 68
Figure 7-6: Typical Drive Bus Voltage Levels for 460VAC Systems (VDC) 69

1. INTRODUCTION

1.1. WHO SHOULD USE THIS MANUAL

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

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

This manual is a user's guide for S3534BR 100% outage DC Bus Sag Ride-Thru Systems. It will provide the user with the necessary information to successfully install, integrate and use the S3534BR cabinet in a variable frequency AC drive system.

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

Digital display data is updated in Rev 01.

Figure 1-1: S3534BR H024-D41 with DD3

2. PRODUCT DESCRIPTION

Bonitron's Model 3534 series of DC Bus Drive Ride-Thru (DRTs) provide protection from AC line voltage sags and outages for AC drive systems that use a fixed DC bus as with AC PWM VFDs. The Model M3534R operates by temporarily storing energy internally and releasing it back into the DC bus when needed. This allows the drive to "ride-through" these events, maintaining motor speed and torque without experiencing drive shutdown.

The S3534BR (Battery Ride-Thru), the S3534CR (Electrolytic Capacitor Ride-Thru), and the S3534UR (Ultra Capacitor Ride-Thru) series of Full Outage DC Bus Ride-Thru Systems incorporate additional energy storage banks and a charging system with the base M3534R Controller module. These battery banks or capacitive energy reservoirs allow the DRT to supply DC bus power to the inverter during total outages of a predetermined duration in addition to its normal sag protection to allow sufficient time for auxiliary power systems to engage before shutdown occurs.

For a failsafe battery system, S3534BR allows bypassing an open battery cell while under load. A typical 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 DRT will make up the lost voltage and maintain the drive bus at threshold. Batteries can now be replaced on a one-by-one basis.

2.1. RELATED PRODUCTS

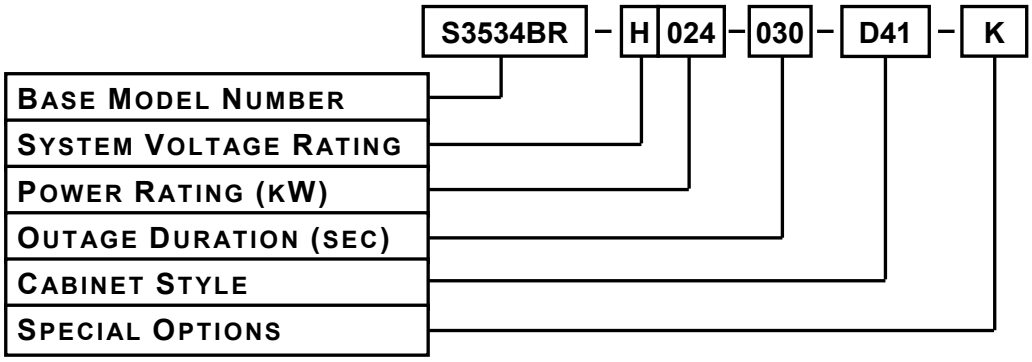
M3528 SERIES: Bonitron Chargers for high voltage storage banks

M3534B SERIES: Bonitron Boost Regulator for battery systems below 50kW

See the Drive Ride-thru Selection Guide in Section 7 for additional information.

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for the Battery Regulator 100% outage, DC Bus Drive Ride-Thru Cabinet System is **S3534BR.**

SYSTEM VOLTAGE RATING

The System Voltage rating indicates the nominal AC/DC voltage levels of the AC Drive system the DRT is intended to support. A code letter indicates the system voltage.

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

POWER RATING

The Power Rating indicates the maximum power in kilowatts that can safely be handled by the S3534BR System.

This rating is directly represented by a 3-digit value based on the nominal DC system voltage rating and the maximum output current rating of the DRT. For instance, the rating code for a 24kW DRT is **024**.

Units are currently available for each of the various system voltages listed above in Table 2-1 up to 85A maximum output current.

OUTAGE DURATION

The Outage Duration indicates the amount of time (in seconds) the S3534BR system 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, **030** in this position represents 30 seconds of Outage Duration.

CABINET STYLE

The Cabinet is determined by the Power Rating. See Table 2-2.

Table 2-2: Cabinet Information

CHX CODE	UNIT SIZE	TYPE	DIMENSIONS (H" x W" x D")
D40	12kW 20A	Type-12	72" x 28 x 10"
D41	24kW 40A	Type-12	72" x 34 x 18"
D43	50kW 85A	Type-12	90" x 40 x 20"

DISPLAY OPTIONS

All standard Model M3534R DC Bus Drive Ride-Thru modules are supplied with a basic set of status indicator lights on the internal Control Board as shown in its User's Manual. Full cabinet systems include the DD3 display as standard, and the DP17 and DP18 display panels as an option.

SPECIAL OPTIONS

Special Options are represented by an alpha code which can be appended after a dash at the end of the model number. Special Options can be used in conjunction with the Display Options. (example: **,–**DP17**,**K)

Table 2-3: Special Option Codes

OPTION CODE	DESCRIPTION
K	Kinetic Buffering
M4	Individual Battery Monitoring
D	Dual Diode Output
DP17, DP18	Analog Display

KINETIC BUFFERING

The Kinetic Buffering Option intercepts an externally generated KB or shutdown signal and allows it to pass only when the S3534BR can no longer maintain adequate DC bus level.

M4

The M3528M4 voltage monitor is designed to monitor DC voltage levels and signal the user if the voltage departs a set range.
The M3528M4 monitors a series of 12V batteries and signals the user if:

- One or more of the battery's voltages fall below the undervoltage set point
- One or more of the battery's voltages exceeds the overvoltage set point
- A fuse is blown
- Over-temperatures exist

D

Each Ride Thru can be connected to more than one drive if isolation diodes are use. The standard "D" option is for using two drives for one DRT system. For systems with many drives, a special diode output module may be used as long as some basic rules are followed as described in application notes. If more than 2 drives will be used, simply add the number of drives after the D. Example: For 4 drives use **D(4)**.

DP17 AND DP18

DP17 and DP18 analog metered panels maybe special ordered by legacy customers for applications where DC bus voltage must be display until it drops below 50VDC.

2.3. GENERAL SPECIFICATIONS

Table 2-4: General Specifications Chart

PARAMETER	SPECIFICATION
Input / Output Voltage	• Units available for 208 – 460 VAC systems • See Section 6.1 of this manual for available Input / Output voltage ratings
Control Inputs	• 24V DISABLE and TEST (see Tables 3-2, 3-3)
Max. DC Output Current	• Units available with ratings of 20A, 40A, 85A max DC output current
Max. Power Rating	• Units available for 6 - 50kW
Outage Duration	• Ranges from 20 to 60 seconds
Minimum Cooling Time	• 30 minutes
Re-charge Time	• About 30 minutes
Indicators	• DD3 Digital Display standard
Counters and Meters	• Data logged in DD3 Digital Display
Power Connections	• AC line input • DC bus output
Fault / Status Outputs	• Disconnect Status • Fault Contacts (see Tables 3-2 and 3-3)
Operating Temp	• 0°C to +40°C
Humidity	• Below 90 % non-condensing
Airflow	• A minimum of 25cfm to prevent hydrogen build-up in case of battery failure

2.4. General 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.

DANGER

- **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.**


DANGER

- 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.


CAUTION

- 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 M3534B WARNINGS AND PRECAUTIONS

DANGER!

- 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.**

CAUTION!

- 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.

3. INSTALLING THE S3534BR RIDE-THRU MODULE

WARNING!

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

Proper installation of the Model S3534BR Ride-Thru Cabinet should be accomplished following the steps outlined below. Be sure to refer to the AC Drive instruction manual as these steps are performed. Please direct all installation inquiries that may arise during the installation and start up of this product to the equipment supplier or system integrator.

3.1. ENVIRONMENT / SITE SELECTION

The installation site for the cabinet should be chosen with several considerations in mind:

- The cabinets have a NEMA-12 rating and will therefore require some protection from the elements.
- The unit will require a minimum clearance of two (2) inches on all sides to allow for proper airflow for cooling.
- The mounting surface should be clean and dry.
- See Section 7.2 for additional installation considerations.

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.

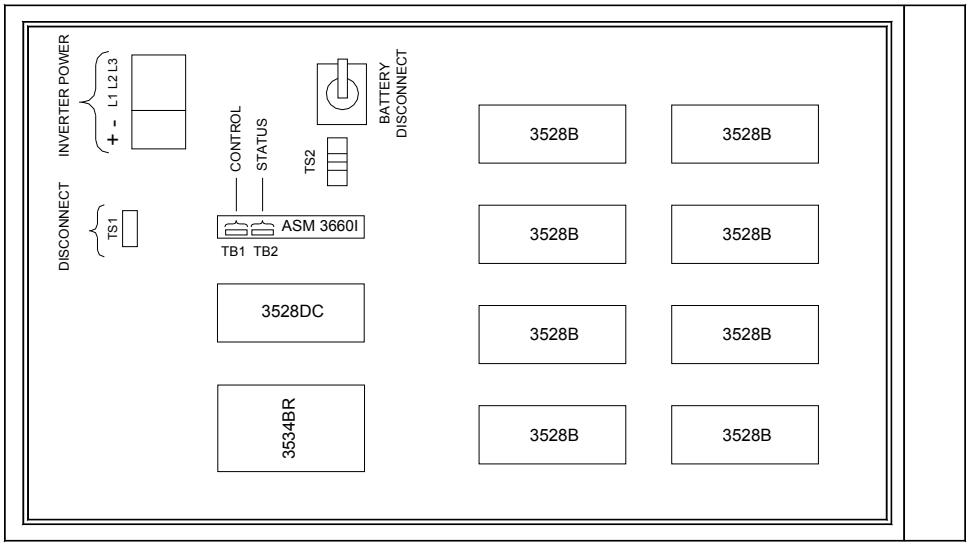
3.3. MOUNTING

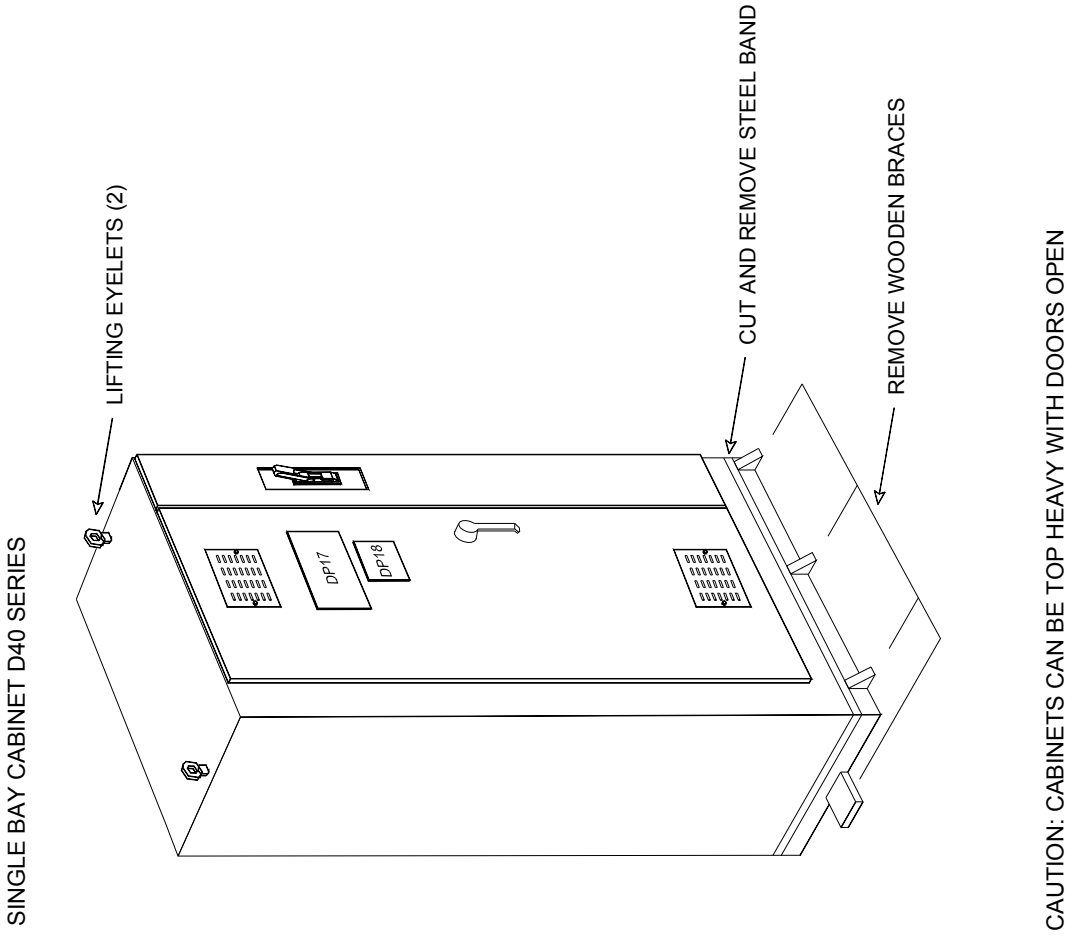
Once the installation site has been selected as outlined above, the unit should be mounted in place. The cabinet is provided with eye hooks for lifting. Required mounting hardware is not supplied with the cabinet.

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

To determine the correct mounting dimensions and provisions for the unit being mounted, please refer to Figures 3-1 and 6-5.

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





3.4. WIRING THE S3534BR RIDE-THRU CABINET

This section provides information pertaining to the field wiring connections of the S3534BR Ride-Thru Cabinet. 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 DRT to Drive Interconnection details listed below before proceeding.

WARNING!

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

CAUTION!

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.

3.4.1. POWER WIRING

GROUND

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

AC LINE INPUT CONNECTIONS

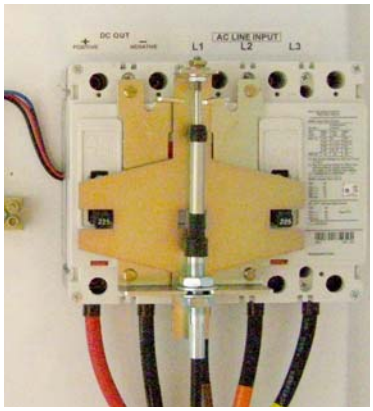
Make AC line feed connections to main disconnect switch (or special terminals for multiple output option) at upper right side of cabinet.

DC BUS OUTPUT CONNECTIONS

Make drive DC bus connections to main disconnect switch at upper right side of cabinet.

Figure 3-2: Field Connections at Main Disconnect Switch

Single Output



Dual Output

Table 3-1: Power Wiring Field Connections

TERMINAL TYPE	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
Disconnect Switch	AC Input L1, L2, L3	600VAC / 85 Amps	10	3 / 0	150 lb-in
Disconnect Switch (Single Output)	DC Output + —	600VAC / 85 Amps	10	3 / 0	150 lb-in
Buss 16280 (Dual Output)	DC Output + —	600VAC / 175 Amps	12	2 / 0	120 lb-in
Stud (Ring Lug)	Gnd		18	2	45 lb-in

3.4.2. CONTROL WIRING

3.4.2.1. MODELS WITH NO DISPLAY

Connect to Booster and Charger modules as shown in their respective manuals.

3.4.2.2. MODELS WITH DPX SERIES DISPLAY

3.4.2.2.1. CONTROL INPUT CONNECTIONS

Make DISABLE connection to TS1 as shown in Figure 3-3.

3.4.2.2.2. FAULT / STATUS MONITORING CONNECTIONS

Make Fault / Status and Disconnect connections to TS1 terminals as shown in Figure 3-3.

Figure 3-3: Control Connections at TS1 for DPx Series

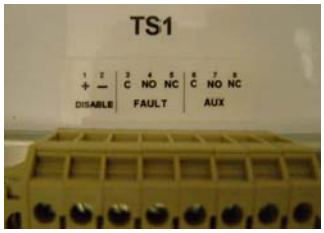


Table 3-2: Control & Status Field Wiring Connections for DPx Series Displays

TERMINAL TYPE	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
Sak 2.5	DISABLE	24VDC / 100ma	22	14	4.4 lb-in
Sak 2.5	FAULT	24VDC @ 1A 115VAC @ 0.5A	22	14	4.4 lb-in
Sak 2.5	DISC	24VDC @ 2A 115VAC @ 6A	22	14	4.4 lb-in

3.4.2.3. MODELS WITH DD3 DISPLAY

3.4.2.3.1. CONTROL INPUT CONNECTIONS

Make Control connections to TB1 on the 3660I2 interface module as shown in Figures 3-4 and 3-9.

3.4.2.3.2. FAULT / STATUS MONITORING CONNECTIONS

Make Fault / Status connections to TB-2 on the 3660I2 interface module as shown in Figure 3-4. Make AUX Disconnect connections to TS1 as shown in Figure 3-5.

Figure 3-4: Control Connections for DD3 Series on ASM 3660I2-RM178

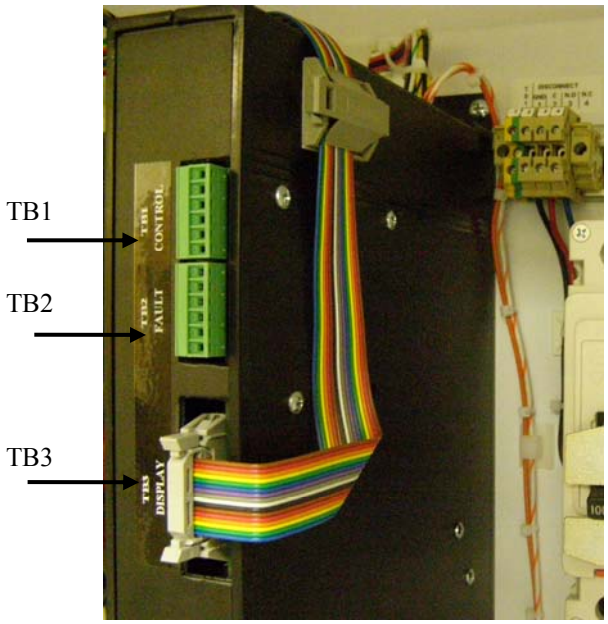


Figure 3-5: Status Connections for DD3 Series

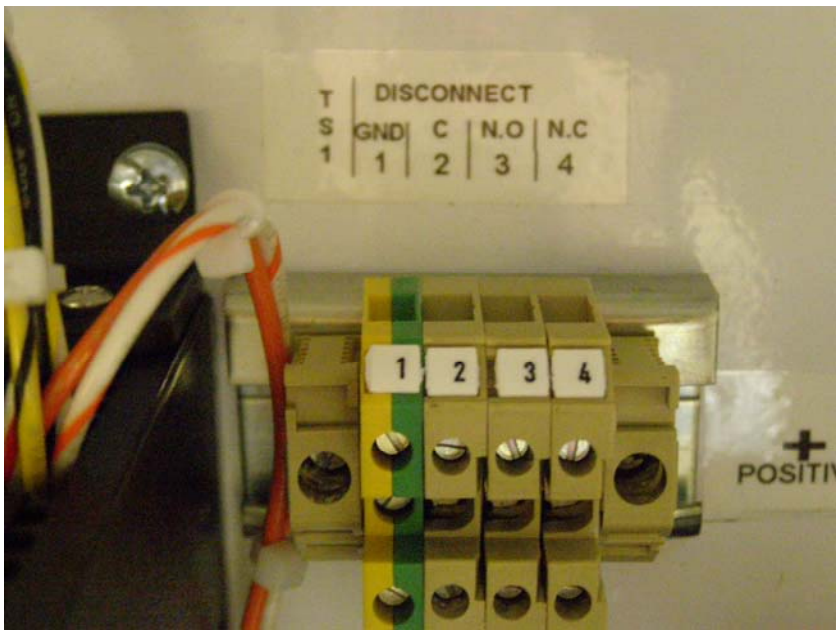


Table 3-3: Status and Control and Staus Field Wiring Connections for DD3 Displays

TERMINAL TYPE	FUNCTION	ELECTRICAL SPECIFICATIONS	MIN WIRE AWG	MAX WIRE AWG	TORQUE LB-IN
Phoenix Plug	CONTROL	24VDC / 20mA	22	14	2 lb-in
Phoenix Plug	STATUS	24VDC / 100mA	22	14	2 lb-in
Sak 2.5	DISC	115VAC @ 6A	22	14	4.4 lb-in

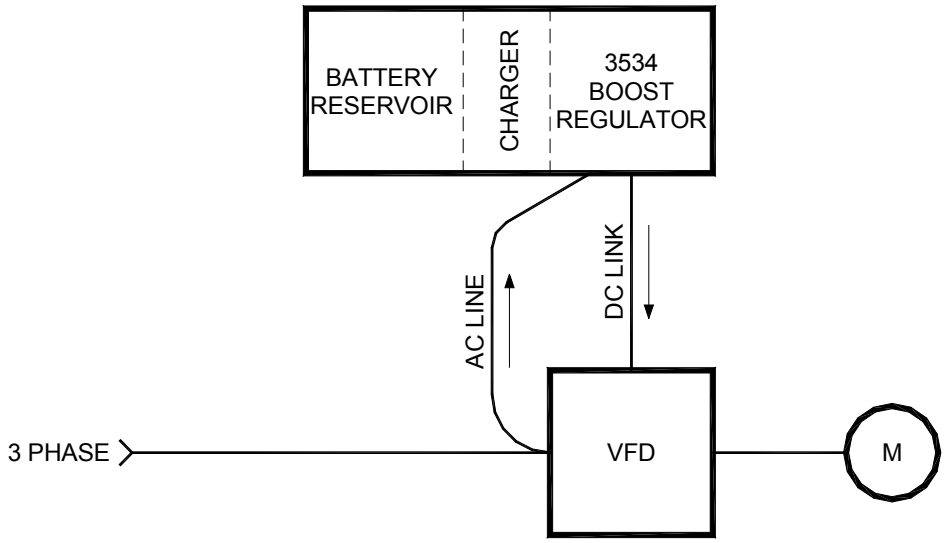
3.5. TYPICAL CONFIGURATIONS

3.5.1. SYSTEM WIRING - DRT TO DRIVE INTERCONNECTIONS

Several illustrations are provided to assist with the field connection of the S3534BR Ride-Thru cabinet 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.

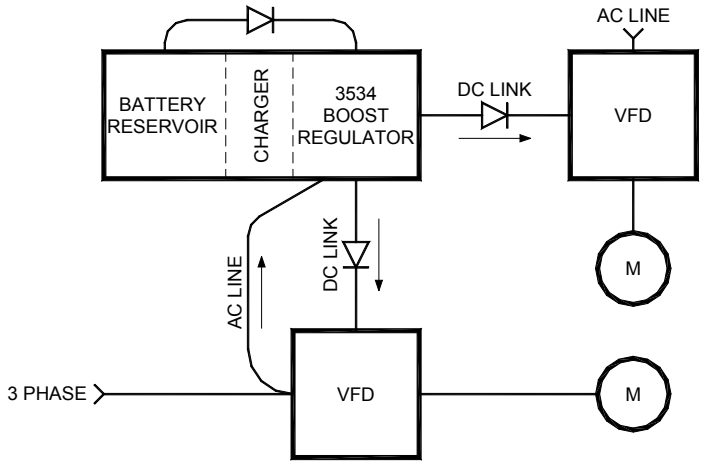
A typical field connection terminal layout for the S3534BR Cabinet power connection is shown in Figure 3-2. Figures 3-6 through 3-8 show a typical power interconnection of the S3534BR Ride-Thru Cabinet with an existing AC drive system.

Figure 3-6: DRT Ride-Thru System Configuration 5



50kW & BELOW, 2 SECOND - 2 MINUTE, 100% OUTAGE PROTECTION
USING DC BOOSTER WITH BATTERY BANK

Figure 3-7: S3534BR Ride-Thru System Configuration 12



50KW & BELOW, 2 SECOND - 2 MINUTE, 100% OUTAGE PROTECTION
USING DC BOOSTER WITH BATTERY BANK AND DUAL OUTPUT

Figure 3-8: Typical S3534BR 50kW and Below Interconnection with Drive System

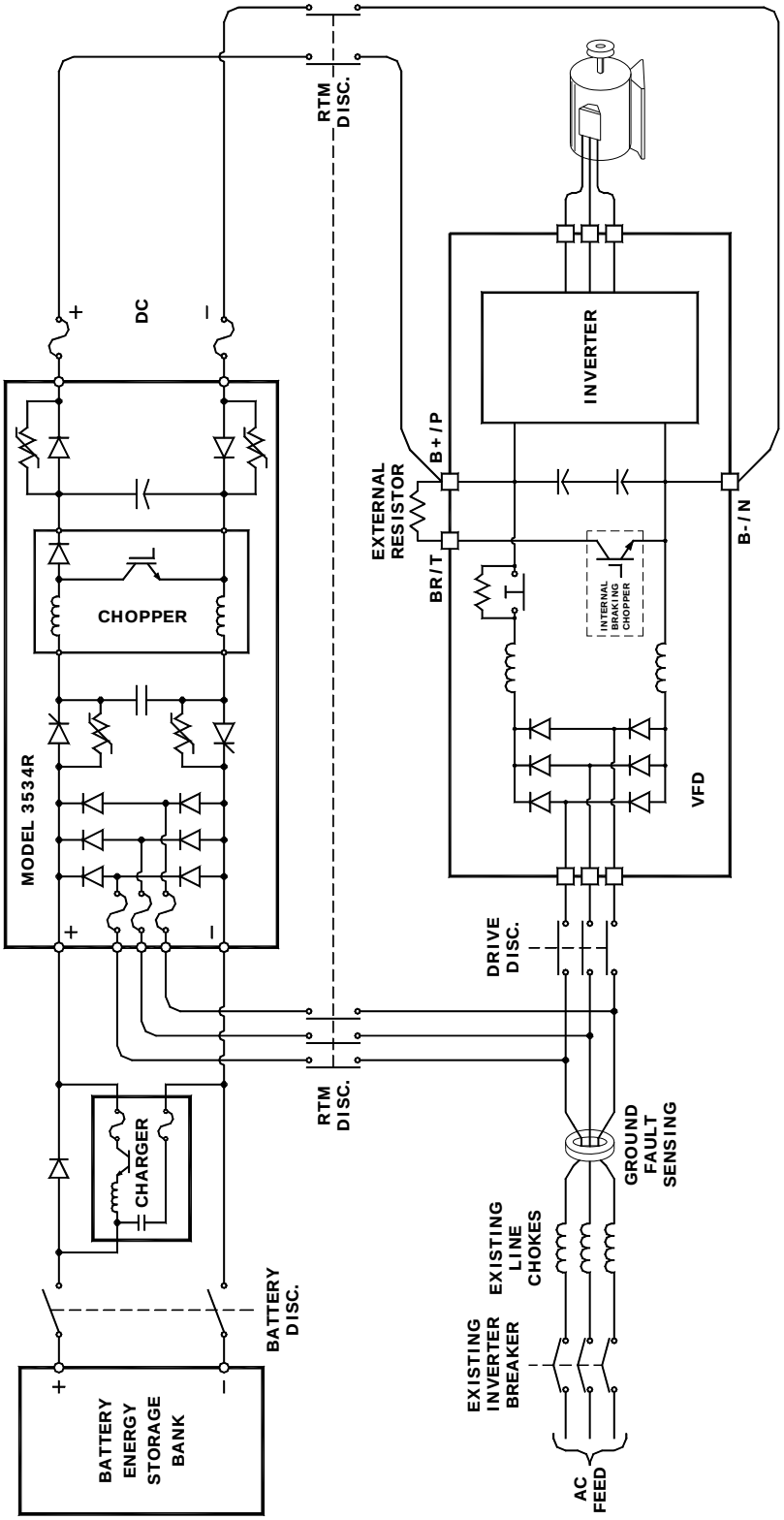
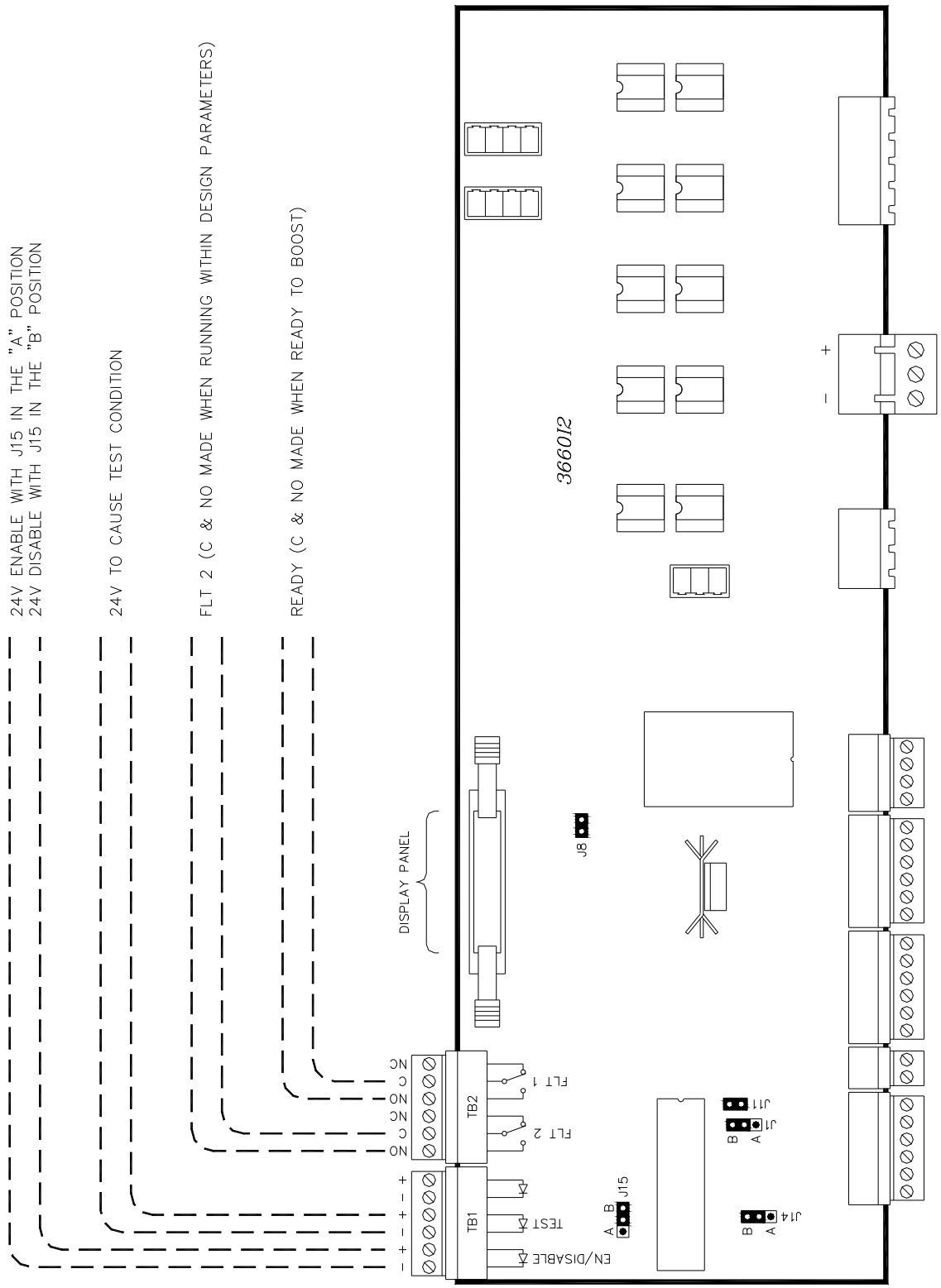


Figure 3-9: Control and Status with DD3



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4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

The S3534BR series of Drive Ride-Thru (DRT) 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 DRT "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.

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 DRT will become "active". When this occurs, the **RT ACTIVE** front panel LED will illuminate, the boost module will take energy from the battery bank to support by DC bus of the DRT. The internal booster cooling fan will begin running in order to cool the internal IGBT heatsink and will continue running for 30 minutes after activity stops.

As energy is drained, the battery voltage will drop and the DRT will boost regulate the battery bank voltage up to the threshold level. If the Open Battery Bypass Option is used, and a battery opens during discharge, the battery monitor will show which battery is open, and will automatically bypass that battery. The DRT will make up the lost voltage and maintain the drive bus at threshold.

The S3534BR system includes input under-voltage (IUV) sensing and is set to change states when the input DC battery bank voltage drops below a predetermined level (400VDC for 460VAC systems). It is recommended to DISABLE the boost module when battery bank drops below its recommended level in order to save the battery bank from a damaging deep discharge. All systems are set up for automatic shutdown at time of production.

If the under-voltage is not set to automatically shutdown the booster, as the battery voltage drops below the capabilities of the boost module, 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 power is restored to the system the boosting activity will stop and the batteries will automatically begin to recharge. The charger will output current until the battery full charge voltage is reached. The current will begin to drop off, and between 200 and 500 milliamps the Charging LED/contact will turn off, indicating the battery bank is about 98% charged.

4.1.2. CONTINUOUS OPERATION

Normal continuous operation for any Ride Thru system is in standby mode with very little heat or power losses generated. If the DRT begins supplying power continuously, possibly due to a low line level, overheated PTC devices, incorrect threshold adjustment, missing input phase, 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 DRT 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

4.2.1.1. S3534BR CABINET SYSTEMS WITH DPX SERIES DISPLAY

RIDE THRU READY (RTR)

- RTR contact will close upon power up when the booster power stages are intact. An unbalance in the DC bus, a blown stage fuse, or a loss of power will cause RTR contact to open.

RIDE THRU ACTIVE (RTA)

- RTA contact will close when the booster becomes active with at least 0.25 amps load.
- Cabinets equipped with a counter will see an increment each time activity occurs.

DISCONNECT

- Both N.O and N.C. contacts are available for monitoring the position of the cabinet disconnect switch.

4.2.1.1.1. FAULT LOGIC DETAILS

The 3534BR systems are equipped with a Fault output contact. This output is accessible via the terminal strip at the top of the DRT cabinet. The output is a dry contact and the Normally Open contact is made under a normal running condition. The Normally Closed contact is made in the Inactive, or fault state.
The following conditions will cause the fault relay to drop out.

- No 15V power to PCB
- An OVER TEMP condition in the battery bank
- An UNDER VOLTAGE condition on the battery bank
  - Factory set up to latch
- An OVER VOLTAGE condition on the battery bank
  - Factory set up to latch

Table 4-1: Fault Logic Table

DRT STATUS	FAULT CONTACT	
	NO	NC
Power off or P.S. failure	Open	Closed
Power on and battery bank OK	Closed	Open
Power on and Ride-Thru Active	Closed	Open
Over temp condition	Open	Closed
Under voltage condition	Open	Closed
Over voltage condition	Open	Closed

4.2.1.2. S3534BR CABINET SYSTEMS WITH DD3 DIGITAL DISPLAY

4.2.1.2.1. OUTPUT STATUS SIGNALS

FAULT 1 OUTPUT

Fault 1 will change states if OUV or BF occur, or if RTR & PCC turn off, signaling to the control room that an operator should go out and check the Ride Thru front panel for more information. This signal may be considered a "READY" signal. Both N.O. and N.C. contacts are available at the connector and the N.O. contact is closed under normal running no fault condition. These faults will be displayed in real time, automatically clearing with the fault.

FAULT 2 OUTPUT

Fault 2 will change states only if Over-Temp, Input Under-Voltage, or Active Time faults occur. If any of these faults occur, and the Ride Thru is in automatic control, the run command will be shut down. If fault 2 occurs, and the display is in manual mode, there should be immediate attention given to the Ride Thru system, and remotely shutting down the boost function should be considered. Both N.O. and N.C. contacts are available at the connector and the N.O. contact will open in a fault condition. These faults will be latched on and will remain displayed until an operator intervenes.

4.2.1.2.2. RUN / FAULT TABLES FOR VARIOUS CONTROL MODES

Table 4-2: Manual Control with Enable Signal

3660I JUMPERS		3660I SIGNAL INPUTS			3660I OUTPUTS			3660D DISPLAY PANEL	
J1 J14	J15	CLASS 1 FAULTS RTR, PCC, BF OUV ØLOSS	CLASS 2 FAULTS OT, IUV OR RTO	TB1 ENABLE	CLASS 1 FAULT	CLASS 2 FAULT	RUN 1 & RUN 2	LATCHING	DISPLAY FAULT INDICATIONS
POSITION **A** OR **"MANUAL"**	POSITION **A** OR **"ENABLE"**	Normal	Normal	High	Normal	Normal	On	-	Normal
				Low	Normal	Normal	Off	-	
		Faulted		High	**Faulted**	Normal	On	No	RTR, PCC, BF OUV, ØLOSS
				Low	**Faulted**	Normal	Off	No	
		Normal	Normal	High	Normal	Normal	On	**-**	Normal
				Low	Normal	Normal	Off	-	
			Faulted	High	Normal	**Faulted**	On	Yes	Temp, Batt UV or RTA Time
				Low	Normal	**Faulted**	Off	Yes	

Table 4-3: Manual Control with Disable Signal

3660I JUMPERS		3660I SIGNAL INPUTS			3660I OUTPUTS			3660D DISPLAY PANEL	
J1 J14	J15	CLASS 1 FAULTS RTR, PCC, BF OUV ØLOSS	CLASS 2 FAULTS OT, IUV OR RTO	TB1 DISABLE	CLASS 1 FAULT	CLASS 2 FAULT	RUN 1 & RUN 2	LATCHING	DISPLAY FAULT INDICATIONS
POSITION **A** OR "**MANUAL**"	POSITION **B** OR "**DISABLE**"	Normal	Normal	High	Normal	Normal	Off	-	Normal
				Low	Normal	Normal	On	-	
		Faulted		High	**Faulted**	Normal	Off	No	RTR, PCC, BF OUV, ØLOSS
				Low	**Faulted**	Normal	On	No	
		Normal	Normal	High	Normal	Normal	Off	**-**	Normal
				Low	Normal	Normal	On	-	
			Faulted	High	Normal	**Faulted**	Off	Yes	Temp, Batt UV or RTA Time
				Low	Normal	**Faulted**	On	Yes	

Table 4-4: Automatic Control with Enable Signal

3660I JUMPERS		3660I SIGNAL INPUTS			3660I OUTPUTS			3660D DISPLAY PANEL	
J1 J14	J15	CLASS 1 FAULTS RTR, PCC, BF OUV ØLOSS	CLASS 2 FAULTS OT, IUV OR RTO	TB1 ENABLE	CLASS 1 FAULT	CLASS 2 FAULT	RUN 1 & RUN 2	LATCHING	DISPLAY FAULT INDICATIONS
POSITION **B** OR "**AUTOMATIC**"	POSITION **A** OR "**ENABLE**"	Normal	Normal	High	Normal	Normal	On	-	Normal
				Low	Normal	Normal	Off	-	
		Faulted		High	**Faulted**	Normal	**Off**	No	RTR, PCC, BF OUV, ØLOSS
				Low	**Faulted**	Normal	Off	No	
		Normal	Normal	High	Normal	Normal	On	**-**	Normal
				Low	Normal	Normal	Off	-	
			Faulted	High	Normal	**Faulted**	On	Yes	Temp, Batt UV or RTA Time
				Low	Normal	**Faulted**	Off	Yes	

Table 4-5: Automatic Control with Disable Signal

3660I JUMPERS		3660I SIGNAL INPUTS			3660I OUTPUTS			3660D DISPLAY PANEL	
J1 J14	J15	CLASS 1 FAULTS RTR, PCC, BF OUV ØLOSS	CLASS 2 FAULTS OT, IUV OR RTO	TB1 DISABLE	CLASS 1 FAULT	CLASS 2 FAULT	RUN 1 & RUN 2	LATCHING	DISPLAY FAULT INDICATIONS
POSITION **B** OR "**AUTOMATIC**"	POSITION **B** OR "**DISABLE**"	Normal	Normal	High	Normal	Normal	Off	-	Normal
				Low	Normal	Normal	On	-	
		Faulted		High	**Faulted**	Normal	Off	No	RTR, PCC, BF OUV, ØLOSS
				Low	**Faulted**	Normal	On	No	
		Normal	Normal	High	Normal	Normal	Off	**-**	Normal
				Low	Normal	Normal	On	-	
			Faulted	High	Normal	**Faulted**	Off	Yes	Temp, Batt UV or RTA Time
				Low	Normal	**Faulted**	**Off**	Yes	

4.2.2. DISPLAYS

4.2.2.1. DIAGNOSTIC DISPLAY PANEL FEATURES (OPTIONAL)

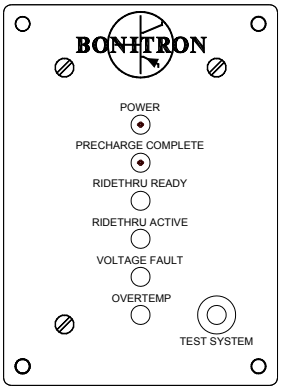
The Ride-Thru Diagnostic Display Panel provides visual indication of the Ride-Thru module's operating status and also permits a system test to be performed. Currently, there are several display panel configurations available with various combinations of features as detailed in Table 4-1 and Figure 4-1.

Table 4-6: Diagnostic Display Panel Configurations

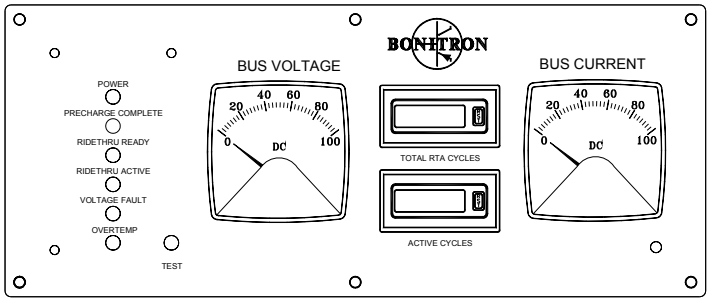
PANEL NUMBER	LEDS & TEST SWITCH	METERS		COUNTERS		PANEL DIMS.
		VOLTMETER	AMMETER	TOTAL CYCLES	ACTIVE CYCLES	
DP2	✓					5" x 3.6"
DP10	✓				✓	5" x 6"
DP17	✓	✓	✓	✓	✓	5" x 12"
DP18	✓	✓				5" x 7"
DD3	✓	✓	✓	✓	✓	7.5" x 5"

Figure 4-1: Display Panels

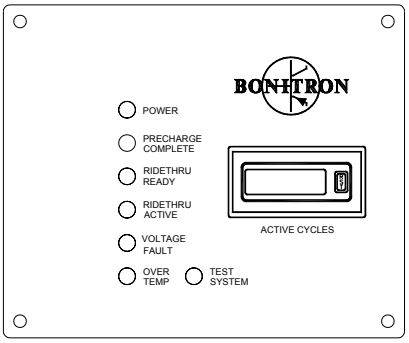
DP02



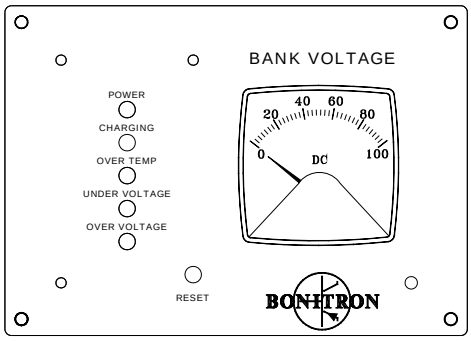
DP17



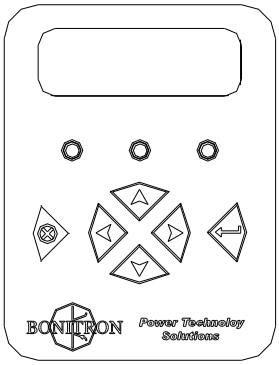
DP10



DP18



DD3



4.2.2.1.1. DP SERIES ANALOG DIAGNOSTIC DISPLAY PANEL FEATURES

The System Status Display module provides visual indication of various system functions. The monitored functions include POWER, RIDE-THRU READY, RIDE-THRU ACTIVE, and OVER TEMP. 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.

POWER LED

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

(RTR) RIDE-THRU READY LED

The green Ride-Thru 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. RTR is only available on 40 amp models.

(RTA) RIDE-THRU ACTIVE LED

The amber Ride-Thru Active LED is ON if the module is regulating the DC bus voltage under an input line sag condition.

OVER TEMPERATURE LED

The red Overtemp LED is ON if the backplate temperature exceeds 130°F.

TEST SYSTEM SWITCH

The Test System push-button switch will cause the Ride-Thru section to raise the DC bus threshold by approximately 17% (see Table 4-7). The inverter input current will drop and the Ride-Thru current will start. The test button should not be pressed for longer than 2 seconds under load. The DPxx series display 'test' button may be disabled by placing ASB 3660D jumper J1 in the "B" position.

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 ± 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, 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 (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.

4.2.2.1.2. DP18 SYSTEM DISPLAY FOR STORAGE SECTION

The DP18 display module provides visual indication of various system functions, including:

- POWER
- CHARGING
- OVERTEMP
- UNDER VOLTAGE
- OVER VOLTAGE

A RESET switch is included for use with the 3528M2 Battery Monitor option.

Table 4-7: System Status Display Reference Tables

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

Key for Table 4-2:
X = on
O = off

4.2.2.2. DD3 SERIES DIGITAL DIAGNOSTIC DISPLAY PANEL FEATURES

See the DD3 Display manual for details on Display set-up and operation.

4.2.2.2.1. INPUT COMMANDS

ENABLE MODE

In this mode an external 24V input command causes the booster to become enabled providing there are no fault conditions. A fault condition may shut down the run command to the booster depending on the position of J1 and J14 and the DD3 display setting.

To make external input an enable command place J15 in the “A” position.

DISABLE MODE

In this mode the booster will become automatically enabled once powered up and all conditions are met. An external 24V input command causes the booster to become disabled, and no boosting can occur. Use this mode if no external run command is used.

To make external input a disable command place J15 in the “B” position.

TEST MODE

In this mode a 24V input will cause the booster output voltage to increase so that the drive rectifier is reversed biased and power will flow from booster, proving switching circuits are operational and fuses are intact. Test can be initiated by an external contact or from the DD3 display panel.

To enable test mode place J11 “ON” (connecting both pins)

To disable test mode place J11 “OFF” (on one pin only)

4.2.2.2.2. CONTROL MODES

AUTOMATIC

In this mode the processor monitors temperature, active run time, and input voltage, and can shut down the boost function if these go outside of desired parameters. These conditions generate a Fault signal (fault 2) and are available for remote notification. The Input under-voltage (IUV) meant to protect the battery bank from deep discharge can be disabled from the front panel in cases where process is more important than battery life.

MANUAL CONTROL MODE

In this mode the processor will only monitor the system status, and will not shut down the run command. In this mode It is recommended that fault signals are monitored, and a remote enable or disable signal be used to stop the switching.

PLEASE NOTE:

In the effort of keeping the Bonitron module from running outside its specifications, Bonitron will ship with the system set up for automatic control. Since some applications are of such crucial importance, we realize the desire to continue running may outweigh any concerns for the Ride Thru modules or battery bank.

If your application is this critical, you may want to use the manual mode.
To place the display in the Manual mode so that automatic shutdown does NOT occur, place J1 and J14 in the "A" positions.
To place the display in the Automatic mode, place J1 and J14 in the "B" positions.

Table 4-8: Automatic Shutdown Truth Table

FAULT2 CONDITION	J1 & J14 POSITION ON 3660I INTERFACE PCB	AUTOMATIC SHUTDOWN ON IUV FAULT
No	Pos "A" (Manual)	No
No	Pos "B" (Auto)	No
Yes	Pos "A" (Manual)	No
Yes	Pos "B" (Auto)	Yes

4.2.2.2.3. DD3 DISPLAY JUMPER POSITION DESCRIPTIONS

The following jumpers are located on the 3660I interface pcb mounted on the boost module, connected to display panel via 16 pin ribbon cable.

J2 = Program enable.
"Off" to program
"On" during normal operation

J11 = Test Mode enable
"On" to enable local or remote test
"OFF" to disable

J1, J14 = Control mode selection
Pos "A" for manual shutdown mode
Pos "B" for automatic shutdown mode

J15 = Run command logic state
Pos "A" for 24V to enable booster
Pos "B" for 0V (no enable connection) to enable booster

4.2.2.3. DD3 SET UP FOR S3534BR SYSTEMS

4.2.2.3.1. FACTORY SET UP WHEN USING DD3 DISPLAY MODULE

RUN COMMAND

Factory set for operation without external input command (J15 in the "B" position).

CONTROL MODE

Factory set for automatic shutdown with IUV disabled from front panel (J1 and J14 in the "B" position and display programmed to ignore IUV for auto-shutdown).

4.2.2.3.2. DD3 SET UP FOR SYSTEM TEST

4.2.2.3.2.1. TO DISABLE PHASE LOSS FAULT SO THAT DISPLAY PANEL CAN MONITOR LIVE PARAMETERS.

See DD3 manual for more details on how to navigate these screens.

1. Press any button to enter the Main Menu screen

- Main Menu screen is displayed

*The following step takes you to a dangerous place where initializing the display can mean a long set back in the start up process.

2. While pressing the down arrow also press the right arrow. Then release the down arrow and press enter while still holding the right arrow
   - Initialize screen is displayed

*DO NOT initialize display or you will regret it! This will cause a complete set up and calibration to be done which means a phone call to the factory and explaining to your boss what happened.

3. Press up or down arrows to choose “select AC or DC”
4. Press enter
5. Press up or down arrows to select “DC”
6. Press enter
7. Press cancel to get back to main menu screen

4.2.2.3.2.2. TO SET UP DISPLAY TO MONITOR BATTERY CURRENT AND OUTPUT VOLTAGE

1. Press up arrow to choose “present status” screen
2. Press up or down arrows to view “output voltage” and “input current” together
3. Press cancel to get back to main menu screen

4.2.2.3.2.3. TO CHANGE TIME DELAY FOR REVERTING BACK TO DEFAULT SCREEN

1. Press any button to enter the main screen
   - Main menu screen is displayed
2. Press down arrow to choose “configuration” screen
3. Press enter
4. Press left or right arrows to set delay time in seconds
5. Press enter

After a factory set time delay of 300 seconds the display is factory set to automatically revert back to the default screen as set up in the “select configuration” screen of the main menu.

This time delay can be set for longer periods until display panel navigation is learned, or shorter periods after placed into operation.

4.2.2.4. AIR FLOW SYSTEM

A small fan is provided in cabinet systems to prevent hydrogen build-up because some ‘gassing’ is normal during the charge cycle. In cases of overcharging, this hydrogen discharge can reach dangerous levels and can become an explosion hazard.

For additional protection or to extend fan life, a hydrogen sensor can be used inside the cabinet.

4.3. S3534BR RIDE-THRU FIELD START-UP PROCEDURE

WARNING!

The S3534BR DRT contains battery modules 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 Bonitron Field Installation Procedure in Section 3.
2. Ensure the Battery Cabinet has been properly installed.
   - Use documentation provided by the battery cabinet manufacturer if a separate cabinet is used..
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, overheat, and drain the batteries. 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 if factory default setting is not within suggested limits.
     - 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 7.2, step 7.
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 Drive 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 MODULES

DANGER!

As battery modules 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 power plugs!

1. Verify that battery disconnect switch is OFF.
2. Re-connect each battery bank by re-installing plugs at the top of each battery module. See Figures 5-1 and 5-2.
   - Refer to Bonitron battery replacement procedure in Section 5.
3. Measure battery string voltage at TS2 terminals 3 & 5.

- Should measure between nominal and charge voltage. See Table 6-4.

4.3.2. POWERING UP FROM INTERNAL BATTERY BANK

Attention!

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.

1. If equipped with a disable command, you may place in disable mode and follow step 2. If there is no ability or desire to disable upon power up go to step 4.
2. With the Ride-Thru cabinet door disconnect turned off, apply power to the Booster and Charger modules by turning on the battery disconnect switch.
   - DP17 **POWER** LED comes **ON**, **RTA** and **OT** LEDs remain **OFF**, **PHASE LOSS** or **VOLTAGE** LED will be **ON**
   - DP18 **POWER** LED comes **ON.**
   - DD3 **GREEN** LED comes **ON**, **YELLOW** LED is **OFF** and **RED** LED is **ON**, P1,P2,P3 phase loss fault is indicated
   - DD3 interface fault 1 contacts change states for phase loss
   - Battery Bank voltage should measure somewhere between “Nominal” and “Full or Float charge” Levels according to Table 6-4.
   - DC output voltage at bottom of cabinet disconnect switch should read the Battery Bank voltage.
3. Remove Disable command to allow booster and charger to operate
   - DP17 **RTA** LED flashes **ON**
   - DD3 will show no change
   - DC output voltage at bottom of cabinet disconnect switch should read the “Threshold” level as shown in Table 6-4.
   - Skip to step 5
4. With the Ride-Thru cabinet door disconnect turned off, apply power to the Booster and Charger modules by turning on the battery disconnect switch.
   - DP17 **POWER** LED comes **ON**, **RTA** LED flashes **ON**, **OT** remains **OFF**.
   - DP18 **POWER** LED comes **ON.**
   - DD3 will show phase loss fault and **RED** LED
   - Battery Bank voltage should measure somewhere between “Nominal” and “Full or Float charge” Levels according to Table 6-4.
   - DC output voltage at bottom of cabinet disconnect switch should read the “Threshold” level as shown in Table 6-4.
5. 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.
   - *If there is more than a 15% difference on voltage between the booster threshold and the drive DC bus the Disconnect switch should not be

closed. In this case the DRT cabinet should be powered up at the same time as the drive.

6. Verify external alarm connections if it is considered important to know if the Ride-Thru is not ready for the next power dip, before it happens.
   - Create faults while remote control room monitors them.
   - Battery disconnect switch may be cycled to create an under-voltage fault, which will in turn cause a fault 2 signal change is using the DD3 display panel
   - Turing on cabinet disconnect in next step will remove phase loss fault which will in turn cause fault 1 signal to change states if using the DD3 display panel.
7. Close door and turn on Bonitron cabinet disconnect.
   - Battery voltage will rise slightly to begin recharging batteries depending on state of charge.
   - Positive battery charge current of up to 2.7 amps may be seen depending on state of charge.
   - DD3 phase loss fault will disappear after a short time delay
   - DD3 interface fault 1 will change states with return of phases
   - DD3 will indicate that the system is charging and the battery voltage will be displayed.
     - 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 **CHARGE** LED will be **ON**, and **CURRENT LIMIT** may come **ON** depending on state of charge.
8. Verify Ride-Thru capability by removing power from the system.

* See Section 4.2.2.3 for special DD3 set up during testing to ignore phase loss fault while test is underway

   - If load is over 0.25 amps.
     - DP17 **ACTIVE** lamp will turn **ON** for duration of event
     - DD3 **YELLOW** LED will turn on **ON** for duration of event
     - DD3 will show phase loss fault and **RED** LED if not ignored
   - Battery voltage will drop from charge level and begin falling as batteries discharge.
   - DP17 current meter or DD3 bar graph display will show current flowing out of the DRT into the drive bus.
   - Inverter DC bus will drop to the Bonitron threshold level of approximately **580VDC** 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.
9. Verify DD3 monitoring parameters to verify a recording of the Ride Thru time and duration.
   - See DD3 manual for details on accessing event statistics.

4.3.3. POWERING UP FROM DISCONNECT SWITCH

Attention!

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.

1. With the battery bank disconnect turned off, apply power to the Booster and Charger modules by turning on the cabinet disconnect switch.
   - DP17 **POWER** LED comes **ON**, **RTA** and **OT** LEDs remain **OFF**.
   - DP18 **POWER** LED comes **ON.**
   - DD3 **GREEN** LED comes **ON**, **YELLOW** LED and **RED** LEDs remain **OFF**
     - In the case of trouble shooting inside the cabinet with door disconnect cheated, the following indications can be seen:
   - Booster **POWER** LED is **ON, ACTIVE** LED is **OFF, OT** LED is **OFF.**
   - Charger **POWER** LED is **ON**, **CHARGE, CURRENT LIMIT** and **OT** LEDs will be **OFF** until battery bank is connected.
   - Battery Bank voltage should measure somewhere between “Nominal” and “Full or Float charge” Levels according to table 6-4.
2. Connect battery bank to system by turning on the battery disconnect switch.
   - Positive battery charge current of up to 2.7 amps may be seen depending on state of charge.
   - DP17 LEDs will not change
   - DP18 **CHARGING** LED comes **ON**, and **CURRENT LIMIT** LED may turn **ON** depending on state of charge.
   - DD3 **YELLOW** LED will turn ON, the bottom display line will indicate “charging” and the top bar graph will show the battery voltage.
     - In the case of trouble shooting inside the cabinet with door disconnect cheated, the following indications can be seen:
       - Booster **POWER** LED is **ON, ACTIVE** LED is **OFF, OT** LED is **OFF.**
       - Charger **POWER** LED is **ON**, **CHARGE** LED will be **ON** until battery is about 98% charged, **CURRENT LIMIT** LED may be **ON** depending on state of charge, and **OT** LED will be **OFF**
   - Battery Bank voltage should begin to increase with charge and measure somewhere between “Nominal” and “Full or Float charge” Levels according to Table 6-4.
3. Verify external alarm connections if it is considered important to know if the Ride-Thru is not ready for the next power dip, before it happens.
   - Create faults while remote control room monitors them.
   - Battery disconnect switch may be cycled to create an under-voltage fault, which will in turn cause a fault 2 signal change is using the DD3 display panel
   - Turing off cabinet disconnect will cause a phase loss signal which will in turn cause a fault 1 signal if using the DD3 display panel.
4. Verify Ride-Thru capability by removing power from the system.
   - *See Section 4.2.2.3 for special DD3 set up during testing to ignore phase loss fault while test is underway
   - If load is over 0.25 amps:
     - DP17 **ACTIVE** lamp will turn **ON** for duration of event

- DD3 **YELLOW** LED will turn on **ON** for duration of event
- DD3 will show phase loss fault and **RED** LED if not ignored

- Battery voltage will drop from charge level and begin falling as batteries discharge.
- DP17 current meter or DD3 bar graph display will show current flowing out of the DRT into the drive bus.
- Inverter DC bus will drop to the Bonitron threshold level of approximately **580VDC** 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.

5. Verify DD3 monitoring parameters to verify a recording of the Ride Thru time and duration.
   - See DD3 manual for details on accessing event statistics.

This completes the start up procedure.

4.4. OPERATIONAL ADJUSTMENTS

4.4.1. THRESHOLD VOLTAGE ADJUSTMENT PROCEDURE FOR MODEL M3534 RIDE-THRU MODULES

The THRESHOLD voltage level is the voltage at which the Bonitron Model M3534 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 normal everyday operation.

During a test cycle the TEST Boost level is typically elevated 17% above THRESHOLD on all Bonitron 3534 Ride-Thru Modules. Table 4-9 below lists the typical factory setpoints for the THRESHOLD, OVER-VOLTAGE, and TEST Boost levels for the Model M3534 Ride-Thru modules based on the system AC or DC input voltage requirements. Be sure to check the Customer Reference manual for each Ride-Thru module for specific setpoint levels.

See Section 7.6 for Typical Drive Bus Voltage levels.

Table 4-9: Factory Setpoints for Threshold and Test Boost Voltages

SYSTEM AC VOLTAGE	BATTERY INPUT VOLTAGE RANGE	THRESHOLD	TEST BOOST	OVER-VOLTAGE
440 - 480VAC	400 - 585VDC	585VDC	+100VDC	702VDC
380 - 415VAC	350 - 485VDC	485VDC	+82VDC	702VDC

4.4.2. DETERMINING THRESHOLD VOLTAGE SETPOINT

Testing and adjustment of the THRESHOLD voltage setpoint can be performed on systems on the test bench, while unloaded and offline as in steps 1-4 of this section, or under on-line and loaded condition as described in Step 8 of Section 4.3.2, or Step 4 of Section 4.3.3.

Note that threshold level drops by approximately 7V-10V from no-load to full-load.

4.5. CALIBRATION

Systems using DPx series displays may require some calibration for the voltage meters.

For DP17 panels the adjustment may be found on the 3534I interface board. For the DP18 panels adjustment is found on the 4460V1 board, or inside the M3628 Ultra Cap Discharge Module (if installed).

Calibration for DD3 series displays should not be needed, but the procedure can be found in the M3660DD3 Digital Display manual.

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

5.1.1. PERIODIC MAINTENANCE PROCEDURES FOR S3534BR WITH DIAGNOSTIC DISPLAY OPTIONS

The Bonitron Ride-Thru is designed to be low maintenance. Because the S3534BR units are part of a Ride-Thru system that uses batteries, Bonitron recommends a yearly test of the system in order to ensure the electronics package is operating and the batteries have storage capability. The following steps can be taken to ensure reliability and give comfort that the system is still able to ride thru a sag event.

1. Check Active cycle counters (if equipped).
   - More than 10 counts per month may mean the Ride-Thru is improperly adjusted. Refer to Section 4.4.1 for adjustment details.
   - Note count for factory records.
   - Report count to Bonitron via your local service representative.
2. Monitor the DP17 or DD3 Display Panel:
   - Green **POWER** LED should be **ON**.
   - Yellow **ACTIVE** LED should be **OFF** (unless recharging).
   - Red **OVERTEMP** or **FAULT** 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 10–35VDC below the Inverter bus.
5. Verify battery voltage meter. See Table 6-4.
6. Monitor DP18 panel LEDs (if so equipped).
   - **POWER** should be **ON.**
   - **CHARGE** LED should be **OFF** unless recent discharge has occurred.
   - All other LEDs should be **OFF.**

Opening the disconnect will cause a phase loss alarm. To prevent the alarm from changing front panel, the phase loss fault can be defeated. See Section 4.2.2.3 for instructions to set up for testing.

7. Verify THRESHOLD and outage time by opening the AC disconnect to the Ride-Thru module (if equipped). Refer to Section 4.4.
   - The DC bus voltage should drop until it reaches the threshold.
   - Current meter should read according to power required by inverter.
   - Yellow **ACTIVE** LED should begin to flash.
   - DC bus should hold at the threshold.
   - This threshold level should be 10-30 volts below the nominal loaded inverter bus. See Section 4.4.
   - TEST is complete when outage time reaches spec, or when battery voltage drops to Discharged level as shown in Table 6-4.

To verify Threshold using the TEST feature, continue with step 8 and refer to Section 4.4.

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.

8. Verify switching circuits by initiating a 2-second TEST sequence 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 to 17% above the threshold.

   NOTE: If inverter is heavily loaded, voltage will not increase the full 17%.
   - Inverter DC bus voltage should rise approximately the same amount.
   - Yellow **ACTIVE** LED should turn **ON**.
   - Motor speed should remain constant.
   - Active cycle counter should increment.

This completes the maintenance procedure.

5.2. MAINTENANCE ITEMS

Maintenance Notes:

5.3. MAINTENANCE RECORDS

Table 5-1: Maintenance record

DATE	MODEL	SERIAL #	RECENT ACTIVITY COUNTER	TOTAL ACTIVITY COUNTER	DRIVE BUS VOLTAGE	STORAGE BUS VOLTAGE	THRESHOLD	RIDE-THRU TIME							

Bonitron welcomes input from end users concerning our product. Please share any comments (good or bad) and any maintenance data recorded here so that we may design better and longer lasting Ride-Thru systems. Information may be sent to Ride-Thru Dept at Bonitron via regular mail or email to jwehman@bonitron.com.

5.3.1. CAPACITOR REPLACEMENT RECOMMENDATIONS

5.3.1.1. CAPACITOR REPLACEMENT CRITERIA

Bonitron Model S3534BR Ride-Thru 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 S3534BR typically is in a standby mode waiting for a power disturbance, and by design has 50% more capacitance than needed.

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 or replaced every 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.)

5.3.1.2. CAPACITOR TESTING PROCEDURE

1. With power applied, 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.
2. Remove power and replace both capacitors.

5.3.1.3. CLEANING

- Cleaning off dust, debris, or chemical build-up on high voltage bus bars or other exposed components may be necessary. If cleaning is needed:
  - Remove power and allow all voltages to drain.
  - Check for residual voltages with meter.
  - Clean affected areas with rag, brush or denatured alcohol, depending on the type of contamination.
  - Once area is clean and dry, reapply power.

5.3.1.4. FANS

1. Fans inside the Booster and Charger modules run only while RT is active and should have a life of 20 years if the RT is properly adjusted. To check operation of fan, temporarily initiate activity.
   - 20 and 40 Amp models: Fan should run for 2-3 minutes after activity stops.
   - 85 Amp models: Fan should run for 30 minutes after activity stops.
   - If fan does not run, replace with equivalent 24V fan.
2. The cabinet fan runs off of 115VAC and runs continuously to prevent heat and hydrogen build-up inside the cabinet. This fan should be checked yearly and replaced every 4 years.

5.3.2. BATTERY REPLACEMENT PROCEDURE

WARNING!

Remember that Model S3534BR contains batteries for energy storage. Be aware that high voltages will exist inside the cabinet once batteries are reconnected after shipment. Only qualified technicians should complete this start up procedure. Protective clothing and gloves according to all applicable codes should be worn when installing this equipment.

5.3.2.1. REMOVING THE BATTERY MODULES

DANGER!

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

1. Ensure cabinet disconnect switch is locked off.
2. Lock out power feed to cabinet if possible.
3. Ensure the battery disconnect switch is in the OFF position.
4. Disconnect the power plug at the top of each battery module.
5. Remove the earth ground wire from stud at top left of battery module.
6. Unplug the temp sensing wires at the bottom of each battery module OR remove the front panel covers from each battery bank and disconnect the temperature sensing wires from TS1 inside each battery module.
7. Loosen 4 screws holding battery module to the backplate.

DANGER!

Battery modules weigh 50lbs each. Be sure personnel removing battery module is able to handle this weight beforehand.

8. Lift up and remove battery module from backplate.

5.3.2.2. REPLACING THE BATTERY MODULES

DANGER!

Battery modules weigh 50lbs each. Be sure personnel removing battery module is able to handle this weight beforehand.

1. Mount battery modules on backplate, and tighten retaining screws.
2. Reconnect the temperature sensing wires to each battery module. Polarity is not important. (Some battery modules have connectors).
3. Reinstall the front panel cover on each battery bank.
4. Reinstall earth ground wire to stud at top left of battery module.

DANGER!

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

5. Reconnect each battery bank by re-installing plugs at the top of each battery module. See Figures 5-1 and 5-2.
6. Measure battery string voltage at TS2.
   - Should measure between Nominal and Charge Voltage. See Table 6-4.
7. Continue with Start-up Procedure in Section 4.3 of this manual.

Figure 5-1: Battery Module Plug Disconnected

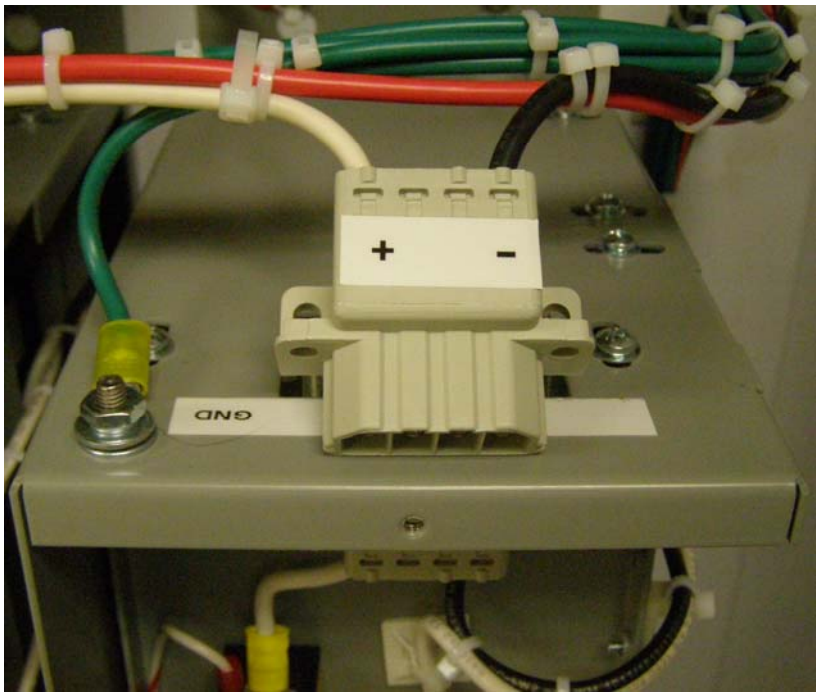
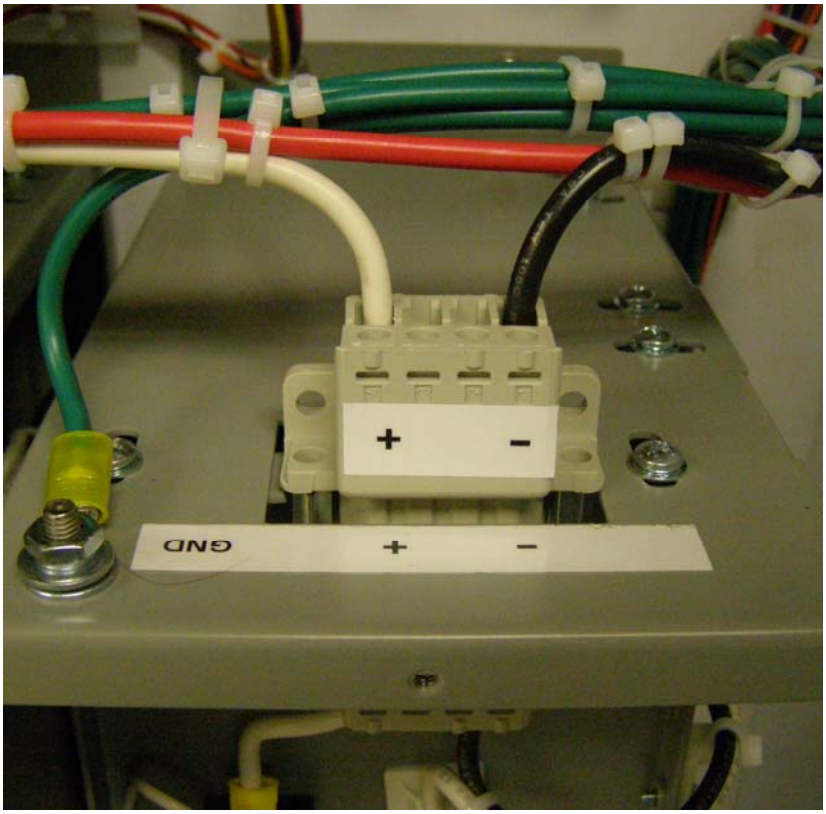


Figure 5-2: Battery Module Plug Connected



5.4. TROUBLESHOOTING

Table 5-2: Troubleshooting Guide

SYMPTOM	ACTION
No front panel LEDs	• Check incoming power • Check power supply from booster • Check isolated power supply out of the display interface
RTA always ON	• Check DC Bus levels on DRT panel and drive panel • Check for overheated precharge ckt • 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 booster module • Lower threshold by at least 10V

RTA never ON	• Check DISABLE command
	• Initiate test cycle or remove power
	  • Watch and listen for signs of activity
	  • Check RTA contact and LED
	  • Ticking sound
	• Check power quality data to confirm sag events that should have caused activity to occur
	• If never any activity, replace booster module

Booster Overtemp	• Check for constant current on the negative or positive DC bus links • Check temp sensors on IGBT heatsink and on chokes • Check activity record – too much activity may cause overtemp • Check precharge network for overheating – (cause of constant activity)
Storage Overtemp	• Check for airflow from charger fan while charging
Battery Overtemp	• Check for proper charge level on batteries
Undervoltage LED ON or DD3 Fault	• Indicates battery input dropped below level shown in Table 6-2
Overvoltage LED ON	• Indicates battery charge level is too high
TEST won't work	• Check DC bus level – too high causes no test • Check TEST jumper on back of DP17 display pcb
Voltage fluctuates during TEST mode	• Check threshold and test boost level settings • Over-voltage shutdown can occur if settings are too high on 460V systems, causing an oscillation affect • Lower threshold level and retry

Stays in TEST mode	• Threshold way too high
	  • Only appears to be in test mode
	  • Can occur in 400V systems if RT is factory set for 585V
	• Check TEST switch on DP17 display

5.5. TECHNICAL HELP – BEFORE YOU CALL

If possible, please have the following information when calling for technical help:

- Serial number of unit
- Name of original equipment supplier
- Brief description of the application
- Drive and motor Hp or kW
- The line to line voltage on all 3 phases
- The DC Bus voltage
- KVA rating of power source
- Source configuration Wye/Delta and grounding

6. ENGINEERING DATA

6.1. RATINGS CHARTS

Table 6-1: Model M3534B Ride-Thru Module Ratings @ 60 Sec

MODEL NUMBER	AC INPUT (VAC)	MAX OUTPUT POWER	RECOMMENDED FUSE RATINGS (DC INPUT / DC OUTPUT)	MAX DC OUTPUT CURRENT	CHASSIS SIZE (H x W x D INCHES)
M3534B-H020	460	12kW	A70Q30 / A70Q25	20ADC	12.5 x 5.1 x 9.5
M3534B-H040	460	24kW	A70Q75 / A70Q50	40ADC	14 x 9 x 8.7
M3534B-H085	460	50kW	A60Q125 / A70Q80	85ADC	22 x 11.9 x 8.7

Table 6-1 Notes:

For higher ratings, batteries can be added.

See Figures 6-1 and 6-2 for extended rating graphs.

Table 6-2: Model M3534B Ride-Thru Module Voltage Levels

AC INPUT VOLTAGE	OUTPUT DC BUS VOLTAGE LEVELS		INPUT DC BUS VOLTAGE LEVELS	
	THRESHOLD	NOMINAL	MINIMUM	MAXIMUM
115VAC	145VDC	160VDC	100	145
230VAC	285VDC	320VDC	200	285
400VAC	500VDC	565VDC	350	500
460VAC	585VDC	640VDC	400	585

Table 6-2 Notes:

The THRESHOLD column in the table above lists the voltage level at which the DC bus will be maintained when the DRT is active during a power loss. This is usually calibrated about 90% of the nominal DC bus level and will drop another 7V when fully loaded.

The NOMINAL column in the table above lists the normal operating DC bus voltage level.

Table 6-3: De-Rating Table

SYSTEM VOLTAGE RATING CODE	AC LINE VOLTAGE	kW RATING 20 AMP	40 AMP	85 AMP
L	208	5	11	22
	230	**6**	**12**	**25**
E	380	9	20	42
	400	**10**	**21**	**43**
	415	10	22	45
H	433	11	23	47
	460	**12**	**24**	**50**

Figure 6-1: Extended Ratings Typical for 85 Amp 400VAC Systems

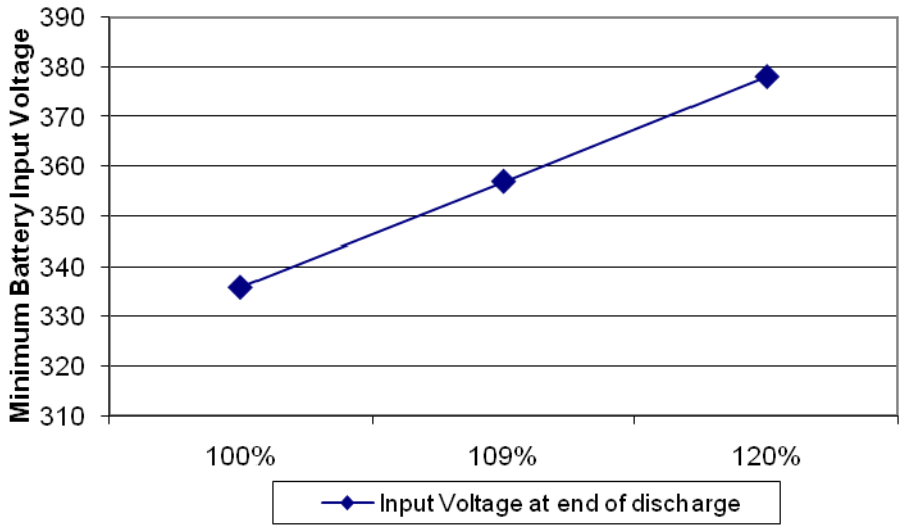


Figure 6-2: Extended Ratings Typical for 85 Amp 460VAC Systems

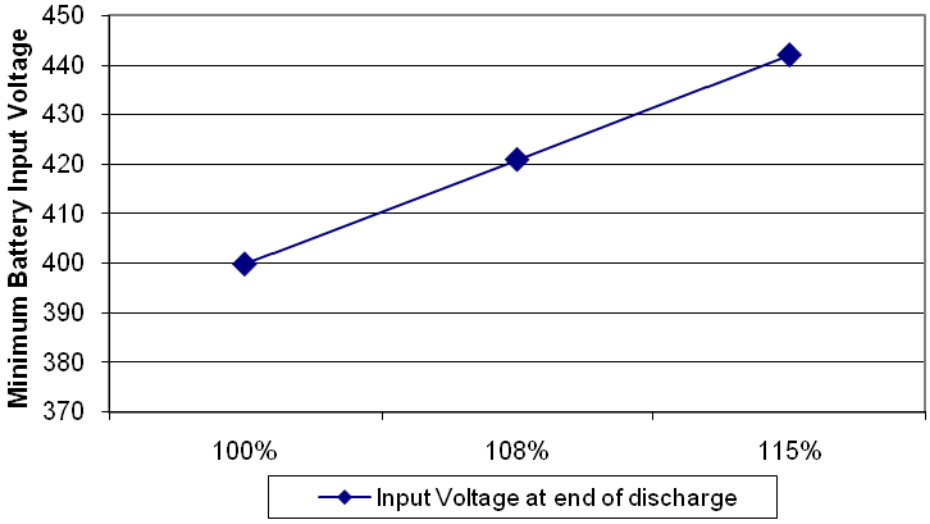


Table 6-4: Typical Storage Bank Configurations

Not to replace manufacturer's recommendations.

	SYSTEM AC VOLTAGE	208	230	400	460
Battery Bank	Nominal Voltage	216	240	420	480
	108VDC banks in series	2	0	4	0
	120VDC banks in series	0	2	0	4
	Full or Float Charge Voltage	243	270	473	540
	Equalize Voltage	249	277	484	554
	Discharged Voltage	180	200	350	400
M3534	Threshold	265	285	485	585

Figure 6-3: Outage without Ride-Thru

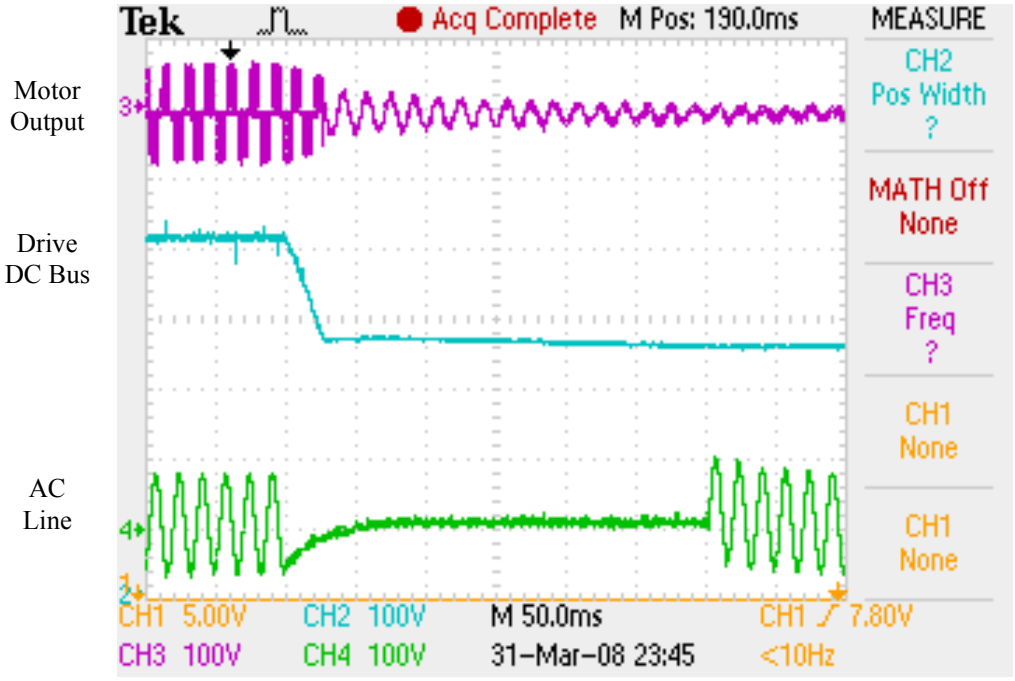


Figure 6-4: Outage with Ride-Thru

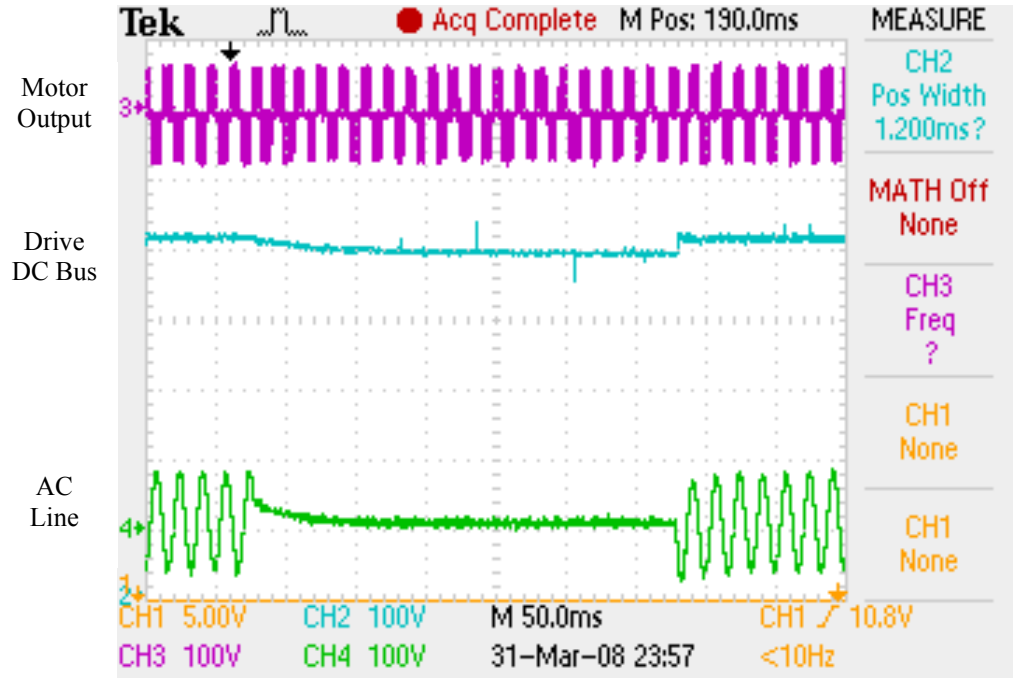
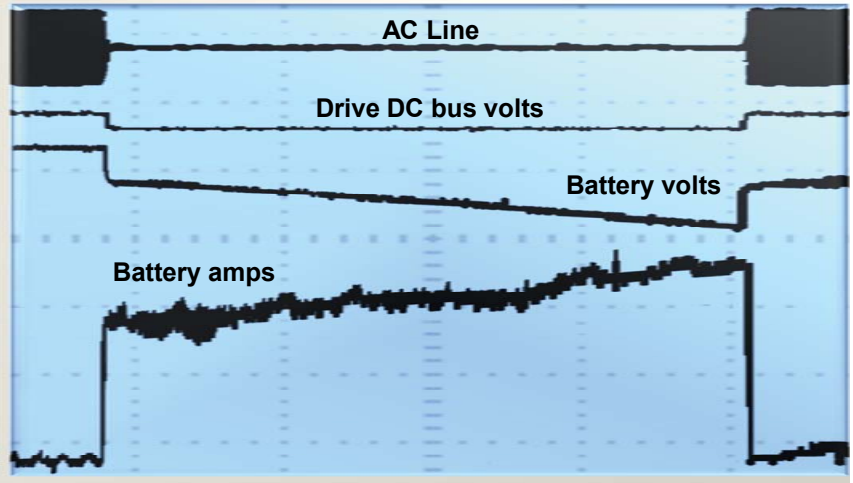


Figure 6-5: Drive System Power Outage with Batteries and Booster



6.2. WATT LOSS

Typical in Standby mode

- 75 watts for 12kW “BR” systems
- 100 watts for 24kW “BR” systems
- 150 watts for 50kW “BR” systems

6.3. CERTIFICATIONS

None.

6.4. FUSE/CIRCUIT BREAKER SIZING AND RATING

6.4.1. RECOMMENDED INPUT POWER WIRING SIZES AND POWER SOURCE FUSING

The following data is supplied for assistance in selecting the appropriate field wiring sizes and power source fuse ratings for the Model S3534BR Cabinet Mounted and Open-chassis Ride-Thru systems.

- Wire size must be coordinated with circuit protection devices and IR drop of wire. It is NOT necessary to size wire for continuous duty. Maximum allowed duty cycle for the S3534BR Ride-Thru is one 2-minute run every 30 minutes.

Table 6-5: Input Power Wiring Sizes and Fusing

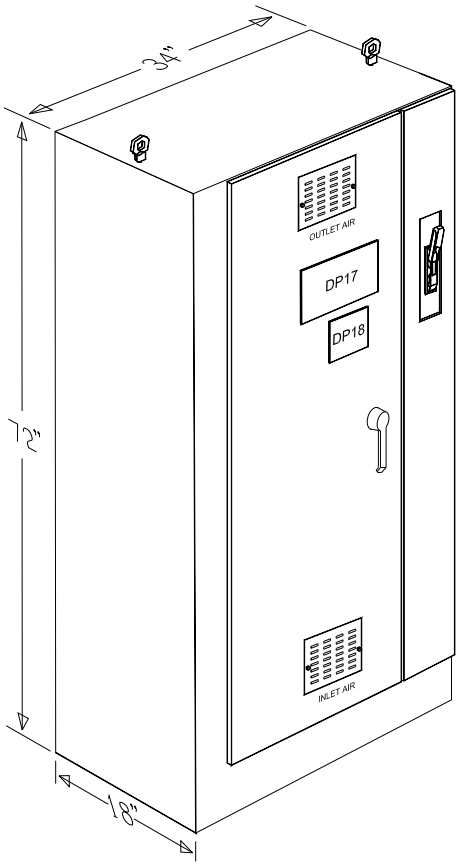
SYSTEM HP	SYSTEM kW	RIDE-THRU DC BUS CURRENT RATING	MIN. SOURCE① FUSING SEMICONDUCTOR	RECOMMENDED FIELD WIRING SIZES	MCM EQUIVALENT WIRING SIZES
13 - 16	10 - 12.5	20 Amps	30 Amps	14 AWG	4 MCM
27 - 32	20 - 24	40 Amps	60 Amps	8 AWG	16 MCM
57 - 67	43 - 50	85 Amps	125 Amps	4 AWG	41 MCM

① Fusing for multiple outputs should be done according to drive power requirements. Always use the lowest amperage fast semiconductor fuse possible.

6.5. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-6: S3534BR D41 Cabinet Dimensional Outline

D41 with DP17 and DP18



D41 with DD3

NOTE: Air inlet on lower left and outlet on upper right is standard.
Other configurations are available upon request.

6.6. SUPPLEMENTAL DRAWINGS

6.6.1. SYSTEMS WITH DPXX DISPLAY PANELS

Figure 6-7: S3534BR-H024-020-D41 Wiring

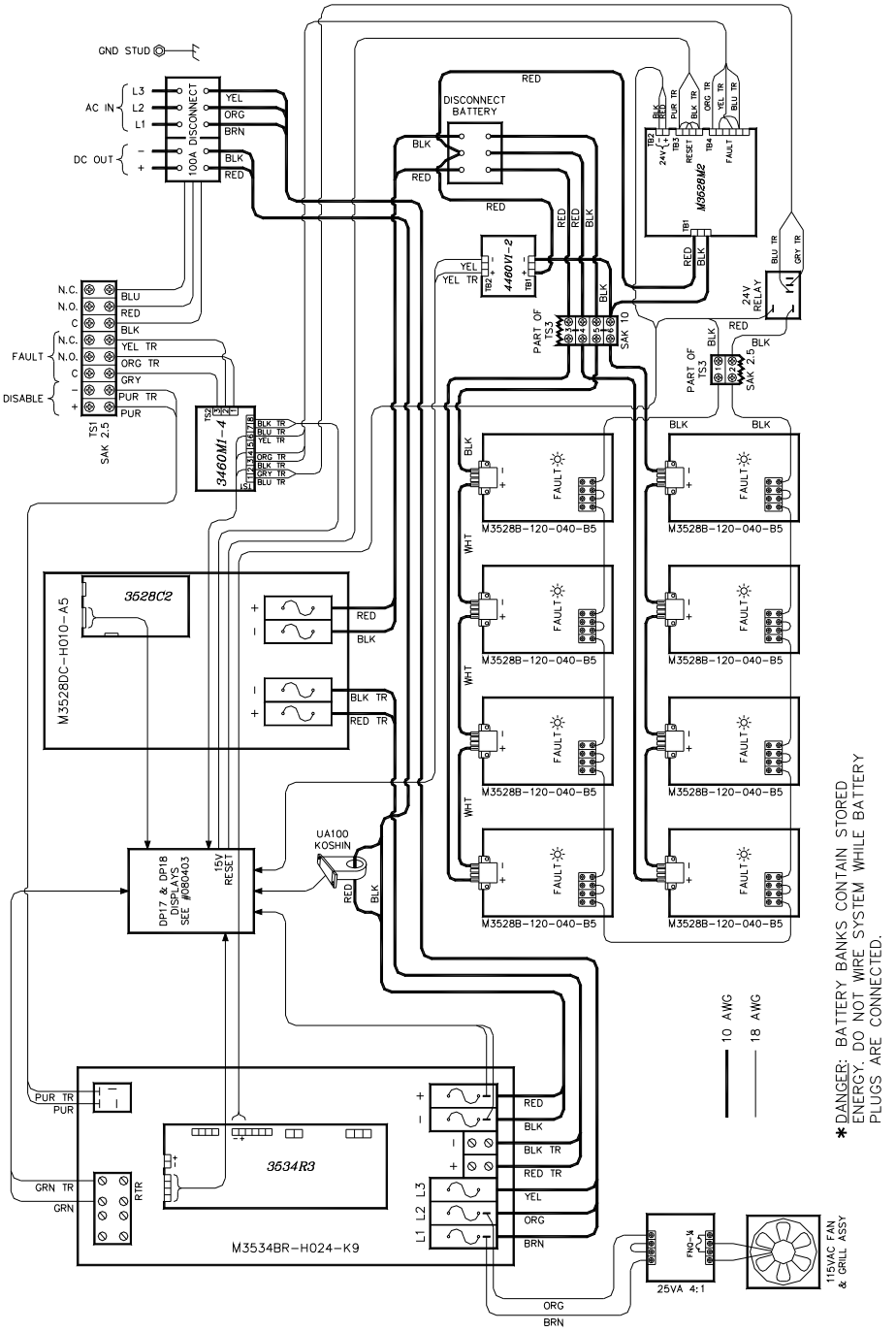


Figure 6-8: S3534BR-H024-030-D41-D Wiring (Dual Output) with DPx Display

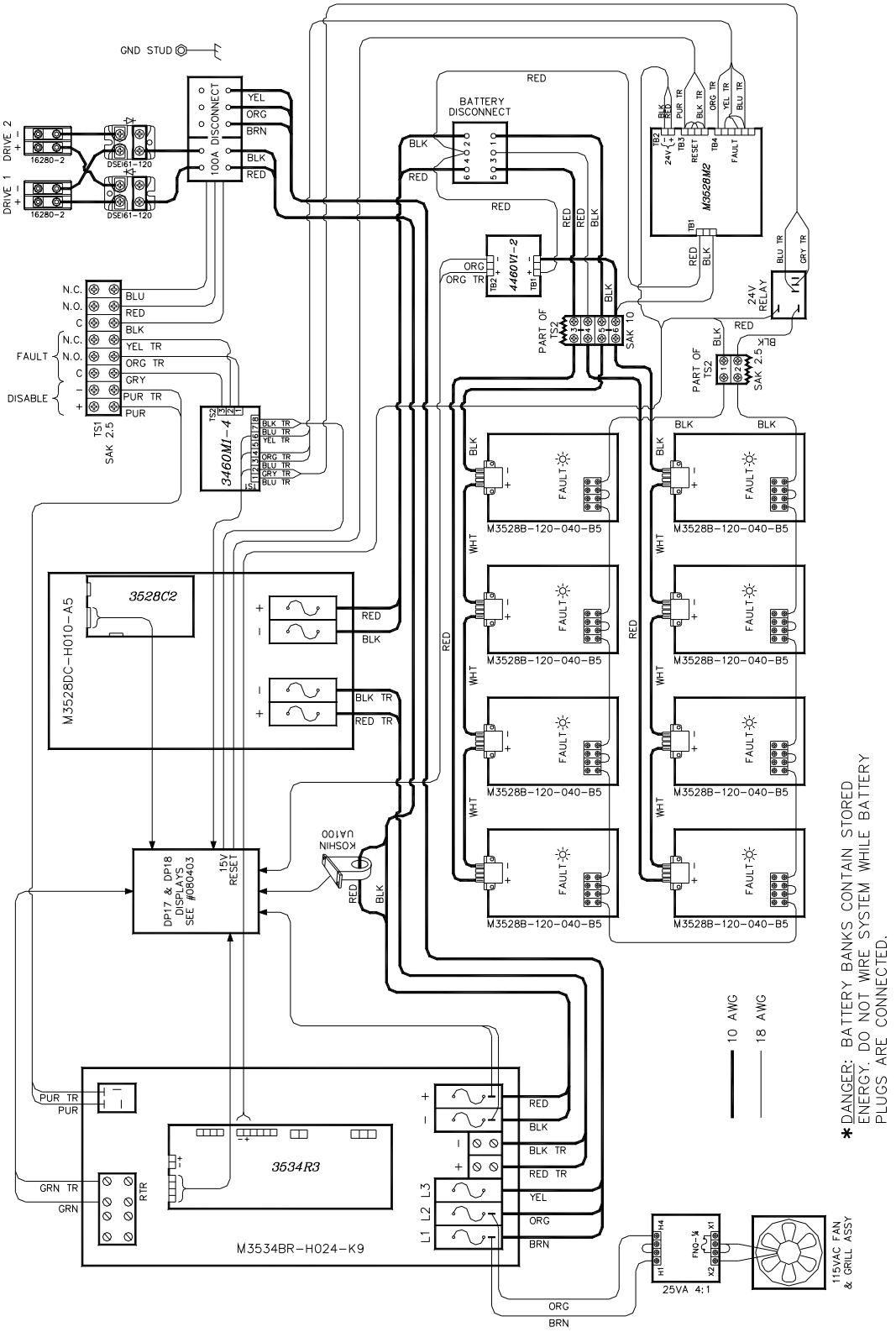


Figure 6-9: S3534BR DP17 & DP18 Wiring

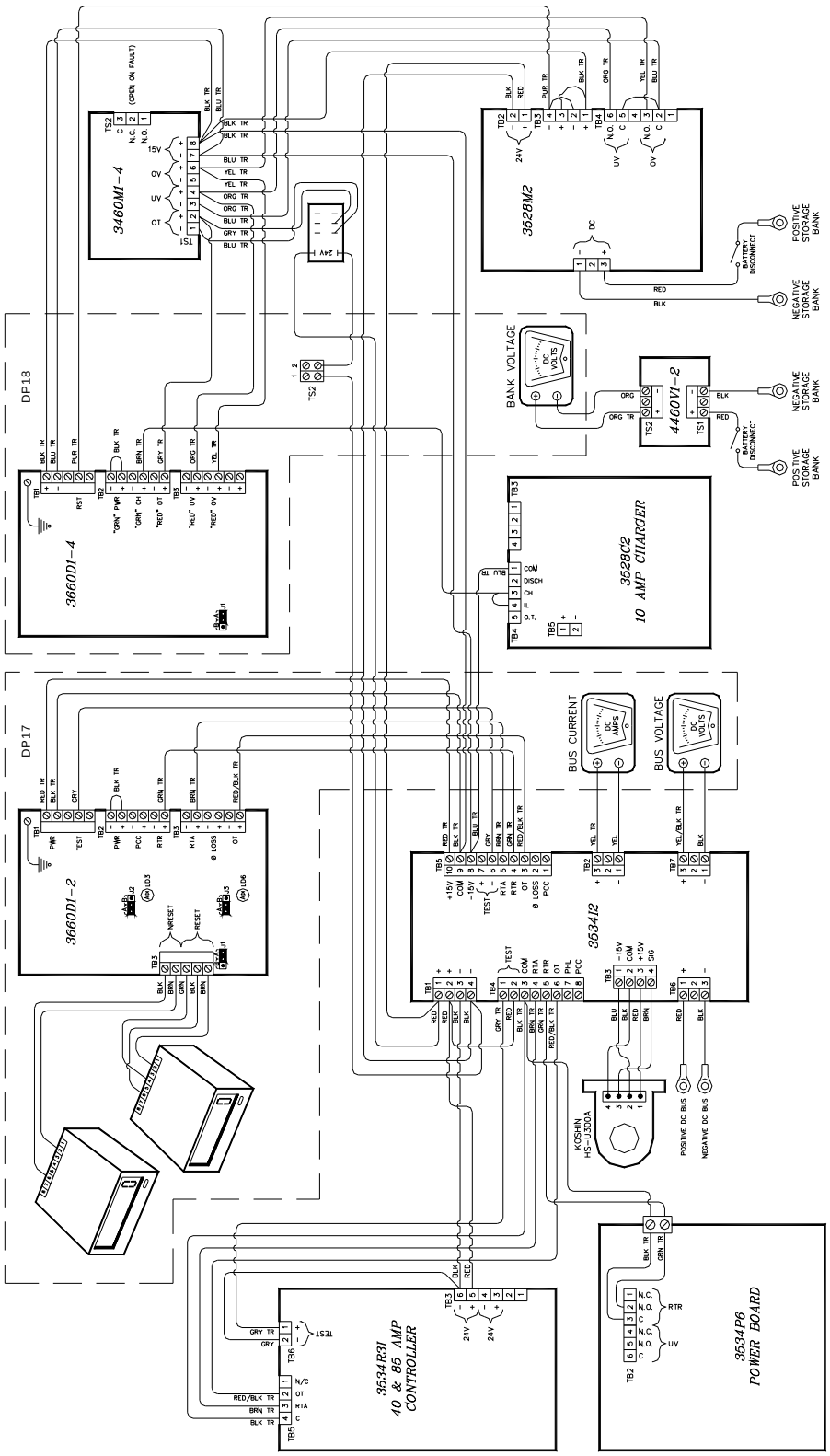
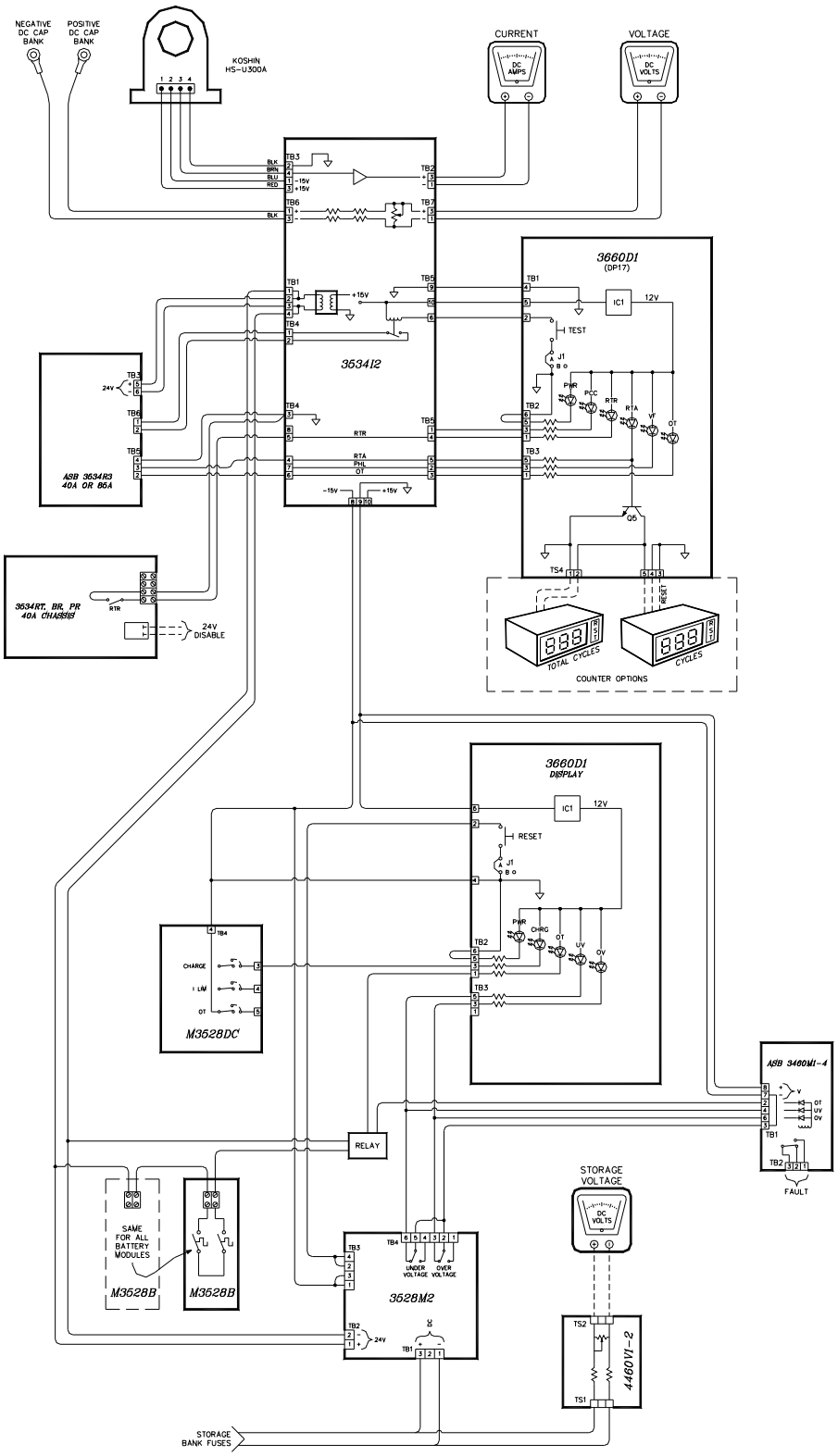


Figure 6-10: S3534BR Diagnostic Signal Connections



6.6.2. SYSTEMS WITH DD3 DIGITAL DISPLAY PANELS

Figure 6-11: S3534BR-H024-030 DD3 Wiring

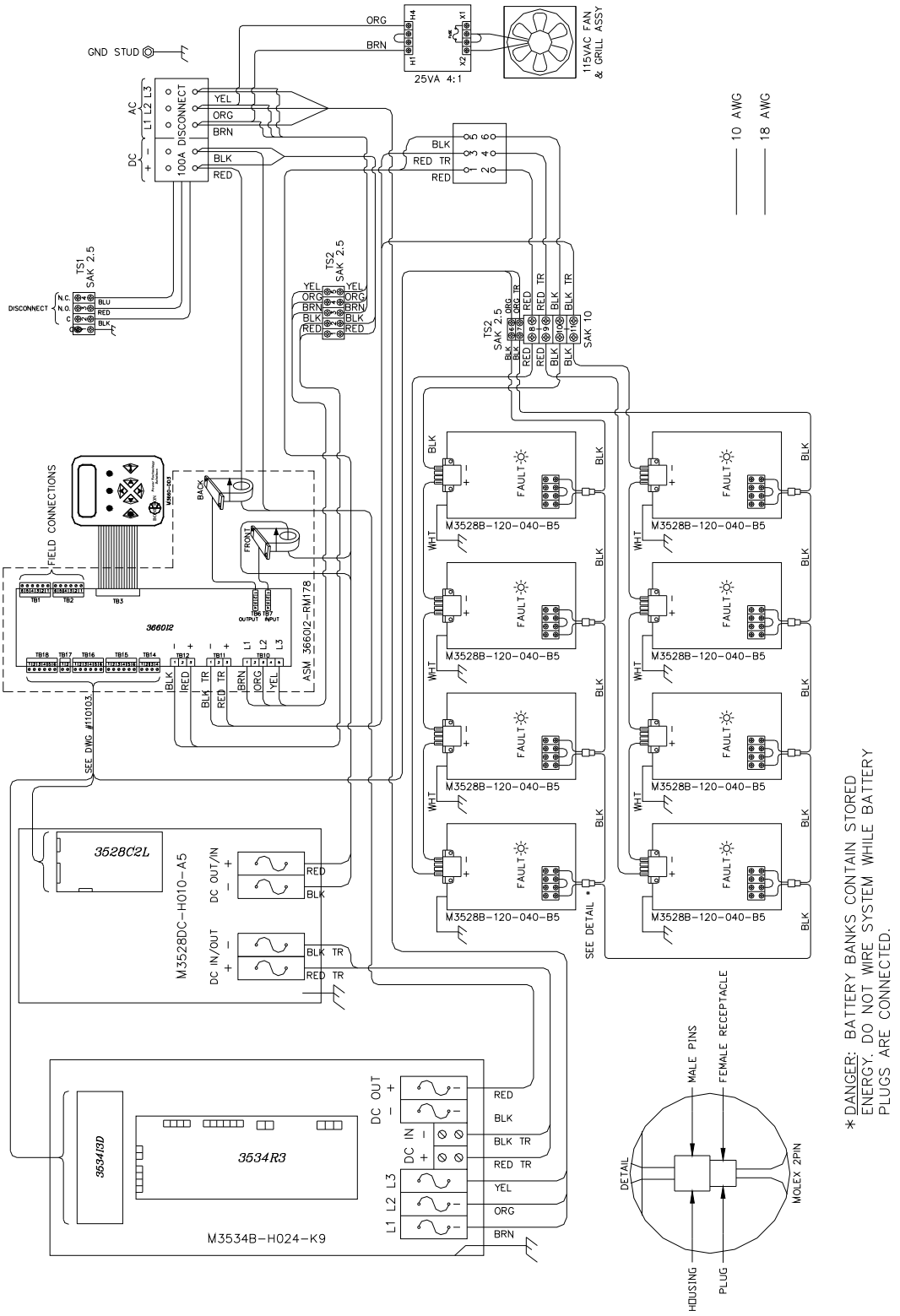


Figure 6-12: S3534BR-H024-030-D41-with DD3 and 3660I2 Wiring

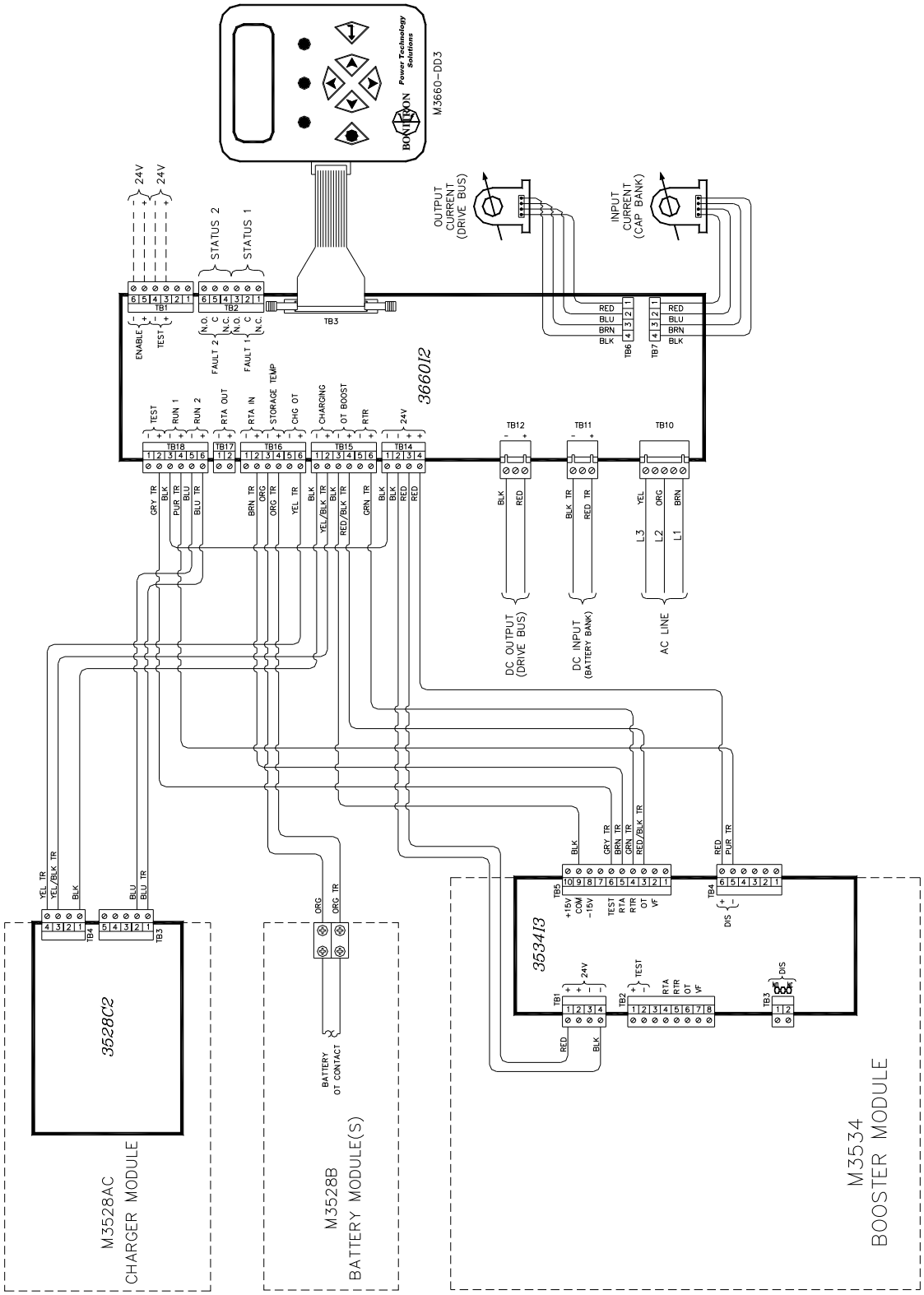
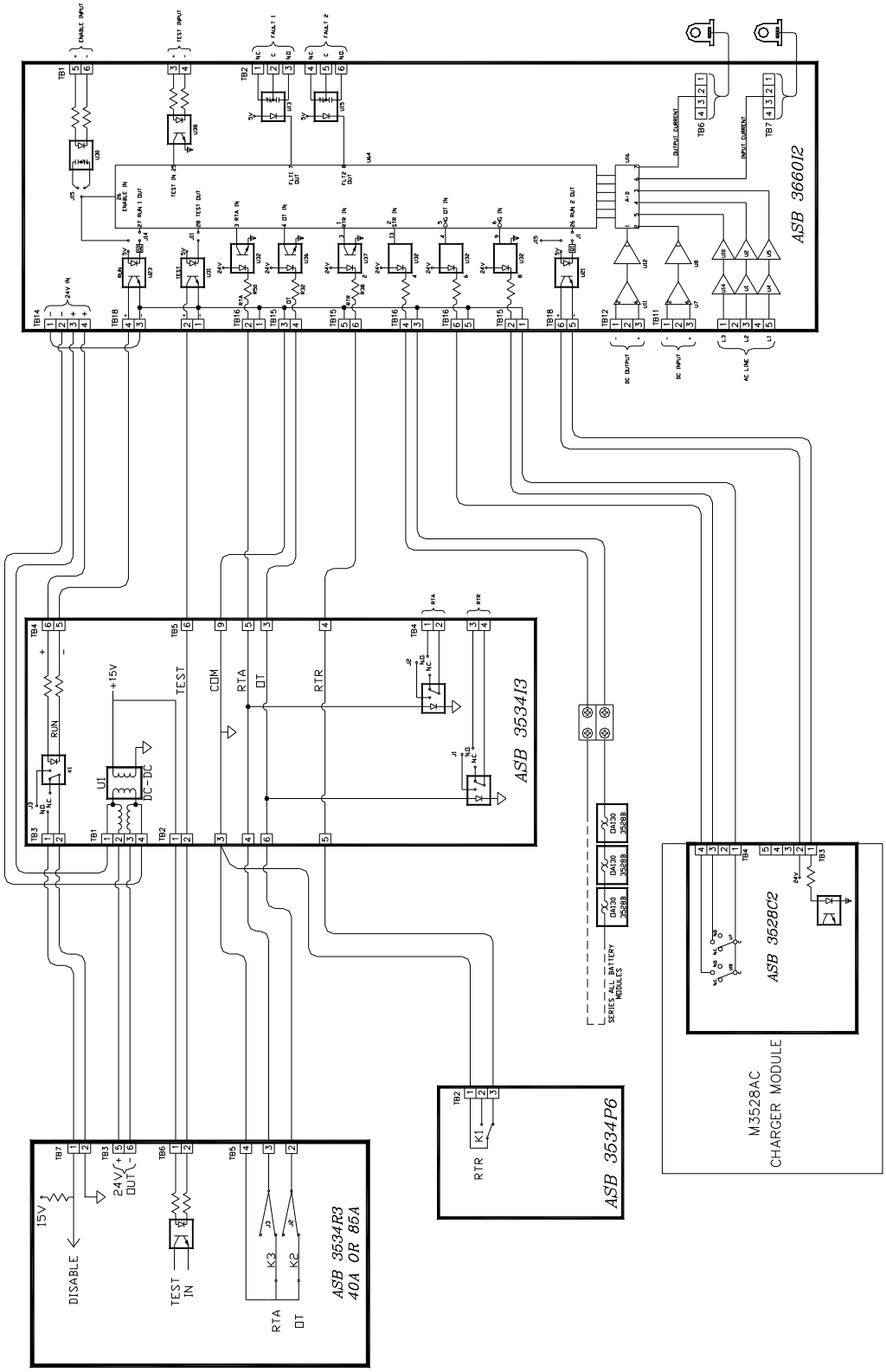


Figure 6-13: S3534BR with DD3 Diagnostic Signal Connections



6.7. RECOMMENDED SPARE PARTS

6.7.1. SPARE PARTS LIST

The part numbers listed in the Table 6-7 represent a listing of all major components and the quantities of each used in various Bonitron Model S3534BR modules.

This list is intended for use as a reference if ordering spare parts for the Ride-thru cabinet 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. 3534R3D10 #125. Please refer to Table 6-6 below). Remember to include every character when ordering spare pcbs to help ensure a proper order.

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

Table 6-6: Example of PCB Serial Sticker

MODEL #	FUNCTION	LAYOUT VERSION	COMPONENT VERSION	SERIAL NUMBER
3534	R3	D	10	125

Each module has a serial sticker. Remember to include every character when ordering spare or replacement modules. Table 6-7 lists the spares for the 24kW 3534BR system.

Table 6-7: Spare Parts List

PART NUMBER	DESCRIPTION / REV	QTY
ASB 3460M1-2	For battery power with DC input (DPx displays only)	1
ASM 3660FP-DP17-H1	1000V 100A display panel	1
ASM 3660I2-RM 178	Digital display interface	1
ASM 3660D	Digital display panel	1
ASM DP18-E	750V display panel for storage bank	1
FS CB-2P-100A	C-H FD2100KL: 2-pole 100A disconnect	1
FS CB-3P-100A	C-H FD 3100KL: 3-pole, 100A disconnect	1
FS CB-A1X1PK	C-H A1X1pk aux swt	1
FS FNQ-.25	1/4-FNQ (500V) Buss slo-blo fuse for cabinet fan	1
M3528B-120-040-B5	120V 40amp battery bank	8
M3528DC-H010-A5	DC input 10A 600V battery/ultra cap charger	1
M3528M2-1	850 VDC voltage monitor (DPx displays only)	1
S3534BR-H024-K9	460V, 24kW, 32 hp battery Ride-Thru	1
RY T92S11D22-24	Sealed Tyco 24VDC dpdt chassis mount relay (DPx only)	1
SW ML2-063-PB4	63A rear panel mount disconnect w/handle	1
XR ISO-025VA	Micron BTZ series: B025BTZ13JK, 25VA transformer	1
EN SCE-FA44	Cabinet exhaust fan	1
EN SCE-FGA44	Fan filter and grill	1

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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 items 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. Verify actual AC line voltage and 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
5. Determine Inverter low bus trip point
   - To ensure "Threshold" level is above inverter dropout
6. Determine Inverter high bus trip point
   - To ensure "Test" level will not over voltage inverter
7. Inverter ground fault circuits
   - Ride-Thru currents on 20 amp model may use inverter bridge neg diodes during operation
   - Circuits can be de-sensitized
   - External ground fault circuits may be added
8. Electrical safety
   - Ride-Thru should not have AC power when inverter does not
     - RT and Inverter should feed from same point
     - Use shunt trip interlock between Inverter and Ride-Thru if RT power is not fed downstream of inverter power switch

- Label inverter as having two power sources

9. DCS monitoring of status signals
   - Alarm contacts
10. Input feed should be capable of 2x rated current during the 2 sec 50% dip for 3534RT models
    - RT RMS rating is 1 percent of system kW
    - Most inverter feeds have been sized for a 150-200% surge for motor starting
11. IR drop of wiring
    - This subtracts from the 50% dip spec
12. Maximum wire sizes allowed into Ride-Thru
    - Different models have standard max sizes
13. Local wiring codes
14. Ambient temperature
    - Under 50°C
15. Corrosive environment
    - Determines cabinet type

7.3. APPLICATION NOTES FOR S3534BR 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. Airflow must be supplied for the purpose of removing hydrogen build up from charging the batteries. This fan should run continuously or be switched from a hydrogen sensor. Standby power losses are less than 300W for booster and charger and transformer. Cooling should continue 12 hours after active cycle starts.
8. A disable command should be given in cases where activity extends beyond the specified ride through time, or in cases where the battery voltage drops below its recommended level.
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 there should be a problem, 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 7-1 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
460	40	480	400	540	554
433	38	456	380	513	526
415	36	432	360	486	498
400	35	420	350	473	484
380	34	408	340	459	470
230	20	240	200	270	277
208	18	216	180	243	249

To choose batteries, follow these steps. We will use a 460VAC system rated for 24W, in need of 1 minute 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 24kW system, ÷ 400VDC min DC input = 60 amps.

** Battery bank must be capable of 60 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.

   a) NOTE: Charging voltage should not exceed the threshold voltage of the boosting system. (Typically 585VDC for 460VAC drive system.)
      ii) Typical recommended charging voltage is 1.125x battery voltage.
      iii) 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.
      iv) Ensure drive losses have been accounted for (95% efficient).
      v) Ensure booster losses have been accounted for (95% efficient).
      vi) Add 15% in time or kW for headroom.
   b) Battery specs usually have watts per cell at discharge rates.
      vii) Watts per cell usually refers to the 2V cell inside the battery.
      viii) Each 12V battery has 6 cells.
      ix) Available watts per cell increases with a longer discharge time.
   c) Ex: 24kW for 1 minute (24kW ÷ 0.95eff ÷ 0.95eff + 15% headroom = 30.5) x 60 sec = 1.83 mega joules .
      x) 40 series batteries x 6 cells each = 240 cells total.
      xi) 1.83 MJ ÷ 240 cells, ÷ 240 sec = 31 watts per cell.

For this application you will need 40 batteries rated for 60 amps that can deliver 31W per cell for 1 minute, with an end voltage of 1.67V per cell.

7.5. BATTERY DISCHARGE RATES

Figure 7-1: M3528B 120V Battery Bank

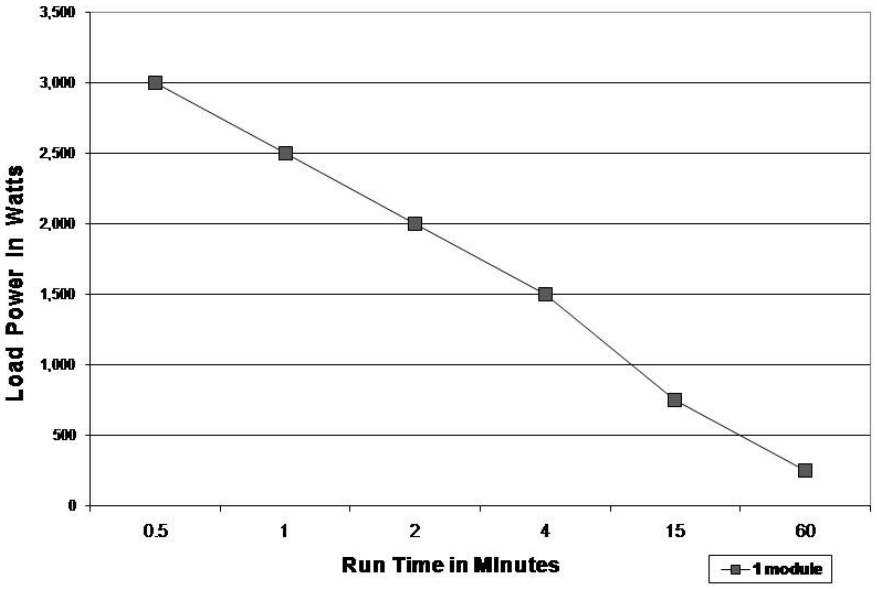


Figure 7-2: M3528B 480V Battery Bank for 460VAC Systems

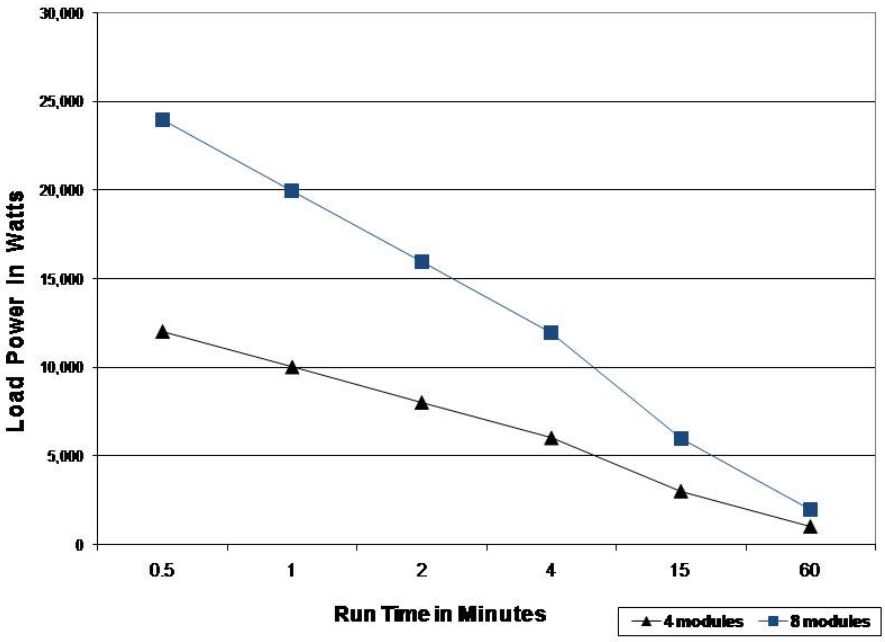


Table 7-2: Battery Discharge Table

Model	Discharge Rate			30 Seconds		1 Minute		2 Minutes		4 Minutes		15 Minutes		1 Hour	
	Bank Voltage	Bank Qty	Battery Type	Watts	Joules	Watts	Joules	Watts	Joules	Watts	Joules	Watts	Joules	Watts	Joules
M3528B-120-040-B5	120	1	GP 1245	3,000	90,000	2,500	150,000	2,000	240,000	1,500	360,000	750	675,000	250	900,000
	120	2	GP 1245	6,000	180,000	5,000	300,000	4,000	480,000	3,000	720,000	1,500	1,350,000	500	1,800,000
	120	4	GP 1245	12,000	360,000	10,000	600,000	8,000	960,000	6,000	1,440,000	3,000	2,700,000	1,000	3,600,000
	120	6	GP 1245	18,000	540,000	15,000	900,000	12,000	1,440,000	9,000	2,160,000	4,500	4,050,000	1,500	5,400,000
	120	8	GP 1245	24,000	720,000	20,000	1,200,000	16,000	1,920,000	12,000	2,880,000	6,000	5,400,000	2,000	7,200,000

**Energy figured at 100V discharge level per module

7.6. DIODE SHARING WITH A BONITRON RIDE-THRU

Diode sharing is used to decrease the cost of implementing regeneration, braking, or Ride-Thru modules to existing drive systems that are not common bussed. The use of diodes prevent drive busses from “back feeding” each other, by allowing energy to pass one way only.

For regenerative applications the energy is allowed to pass from the drive bus to the regen or resistive braking module, but is blocked from passing from regen or brake module to the drive.

For Ride-Thru applications, the energy is allowed to pass from the Ride-Thru module to the drives, but is blocked from the drives to the Ride -Thru. Figure 6-10 is a block diagram example of a Ride-Thru / diode application.

Below are some basic guidelines for using diodes in this manner for 50% sag Ride-Thru applications:

1. Drives should have equivalent DC bus levels as would be found on equal size drives of a common manufacturer. (See Figure 7-2)
   a. If positive and negative busses are different potentials, the standard precharge may overheat and the Ride-Thru may be constantly active.
2. Drives should be on same AC feeder in same cabinet or close proximity.
   a. Different feeds may have different potentials and may cause circulating currents or ground faults.
3. Drives should have a common line choke or harmonic filter
   a. Any input filter should be common to all drives on a single Ride-Thru. (See Figure 7-1)
      - The use of individual input harmonic filters or line chokes can cause unequal potentials with respect to earth.
4. Ride-Thru connection should be downstream of any input line filter.
   a. Input line filters cause lower DC bus levels. If a Ride-Thru is placed upstream, the Ride-Thru DC bus will be higher than the drive bus, and energy will flow full time out of the Ride-Thru module which may cause constant activity and overheating.
   b. Special SCR input models are available for applications where a downstream connection point is not available.
      - It may be necessary to lower the threshold for these applications.
5. Ground Fault sensing should be done upstream at common point of line connection, upstream of line filter if used.

Figure 7-3: Diode Sharing (Not) Recommended With Individual Line Chokes

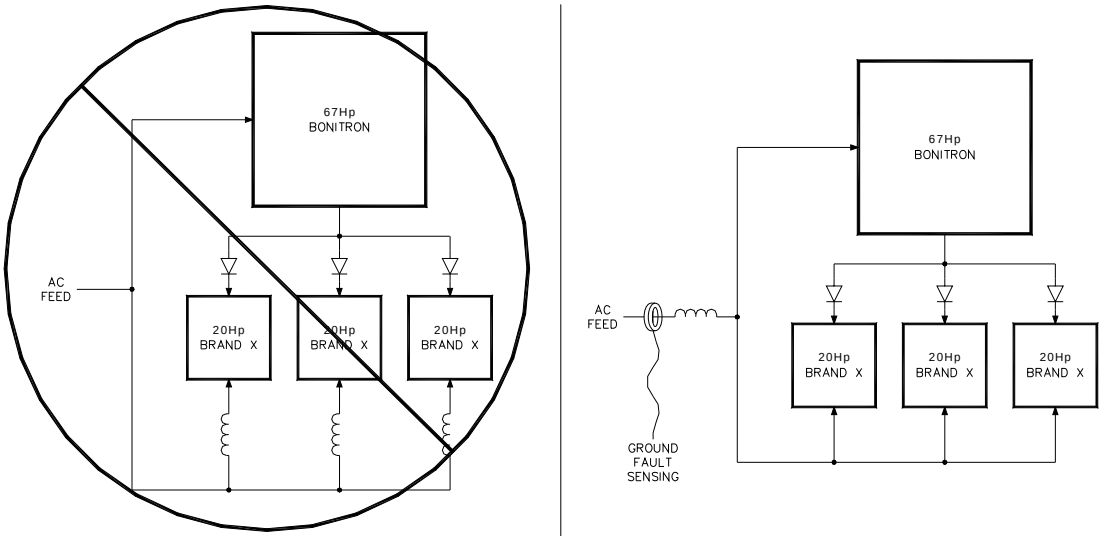
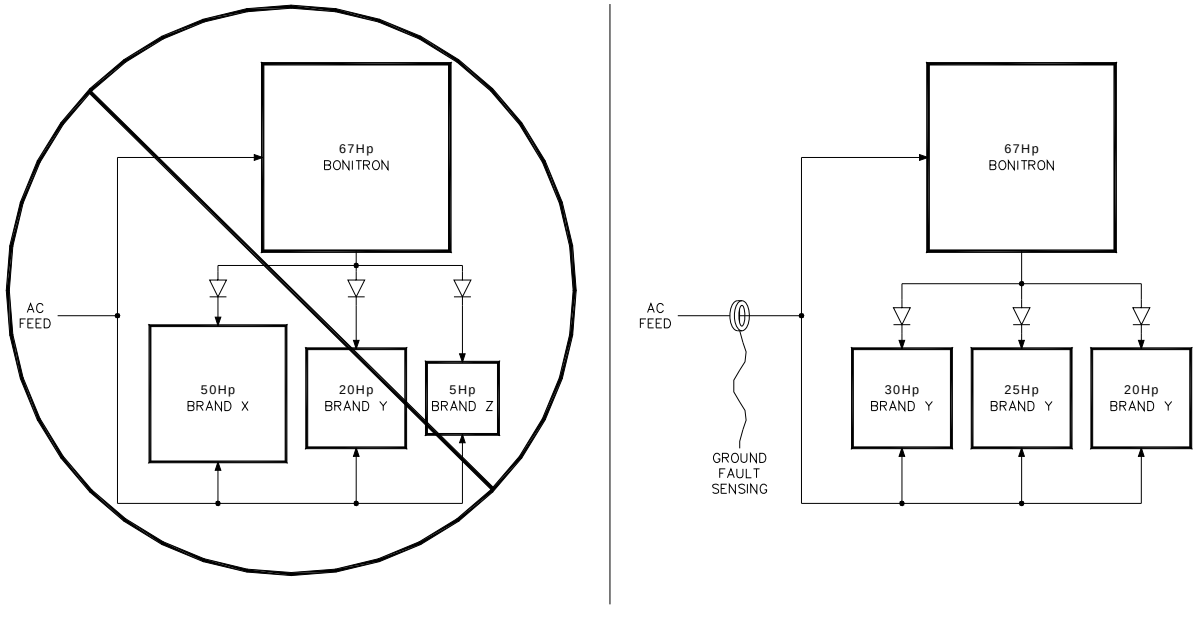


Figure 7-4: Diode Sharing (Not) Recommended With (Non) Equivalent Drives



7.7. TYPICAL DRIVE BUS VOLTAGE LEVELS

Figure 7-5: Typical Drive Bus Voltage Levels for 400VAC Systems (VDC)

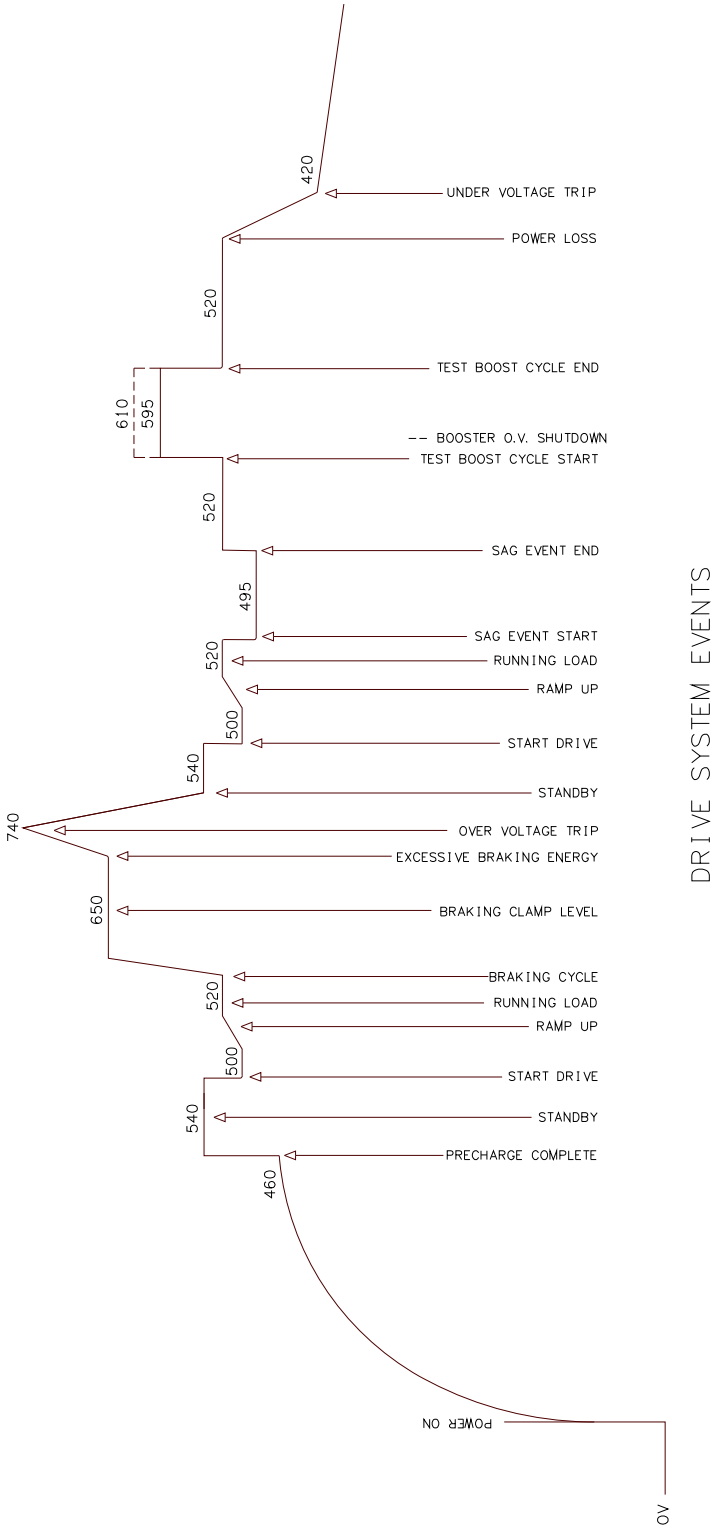
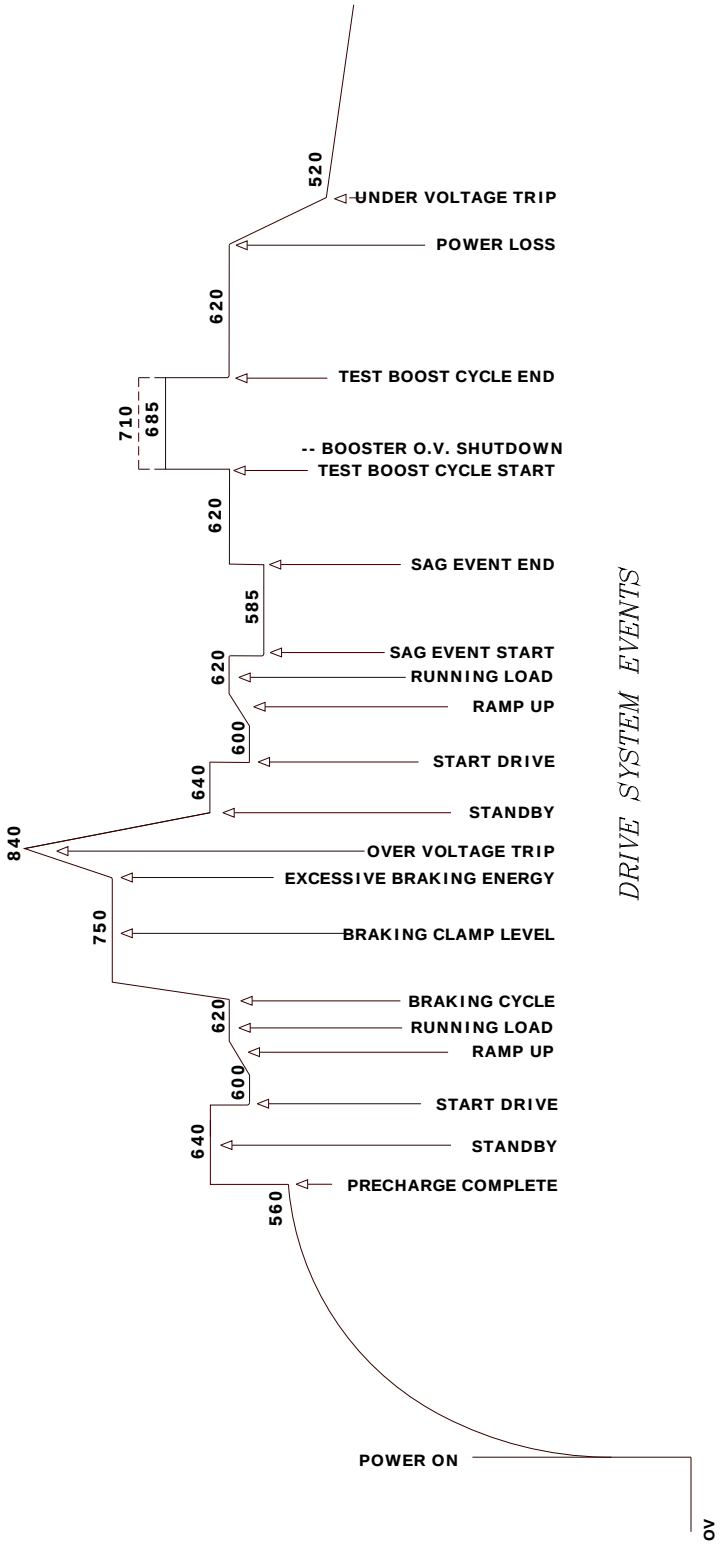


Figure 7-6: Typical Drive Bus Voltage Levels for 460VAC Systems (VDC)



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