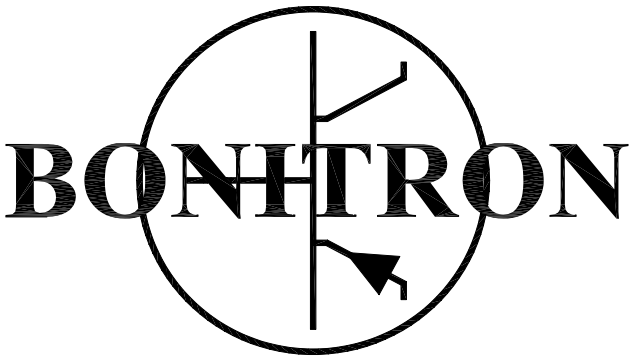

Model M3532-D24V-2.6kJ-M3

24V Contactor Ride-Thru with Current Feedback

Customer Reference Manual

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Bonitron, Inc.

An Industry Leader in AC Drive Systems and Industrial Electronics

OUR COMPANY

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

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

Sales of equipment, generated mainly by reputation and referrals, are worldwide. The customer base includes ABB, Allen-Bradley, Control Techniques, GE, Magnetek, Reliance, Siemens, and other fine companies. Equipment is installed in most of the fifty states, Canada, Mexico, Brazil, Argentina, Northern Ireland, Holland, Spain, India, Hungary, Turkey, Indonesia, and China.

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 adjustable speed drives. Bonitron's Ride-Thru Module provides protection from AC line voltage sags while the Line Regen and Resistive Braking modules provide DC Bus regulation for over-voltage due to regenerated voltage. Today, many drive system integrators use Bonitron AC drive option modules with their adjustable speed drives.

WORLD CLASS PRODUCTS

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

Some Bonitron products include:

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

Table of Contents

1. INTRODUCTION

1.1. WHO SHOULD USE

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

Please keep this manual for future reference.

1.2. PURPOSE AND SCOPE

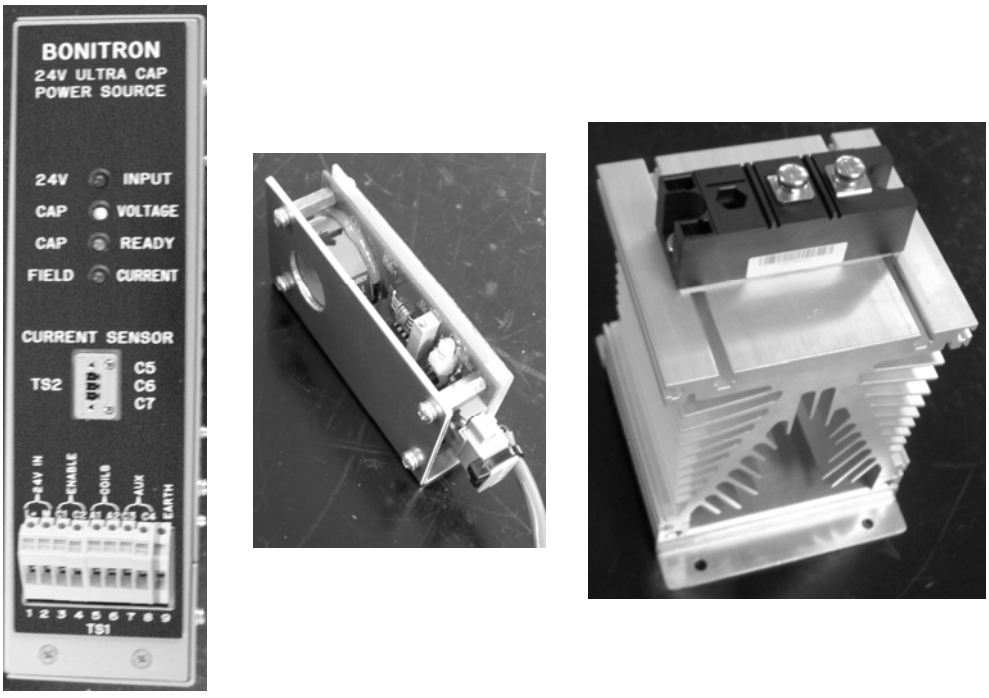
This manual is a user's guide for the Model M3532. It will provide the user with the necessary information to successfully install, integrate, and use the M3532 in a DC Drive system.

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

1.3. MANUAL VERSION AND CHANGE RECORD

Rev 00 is the initial version of this manual.

Figure 1-1: M3532 Controller, Current Sensor and Diode



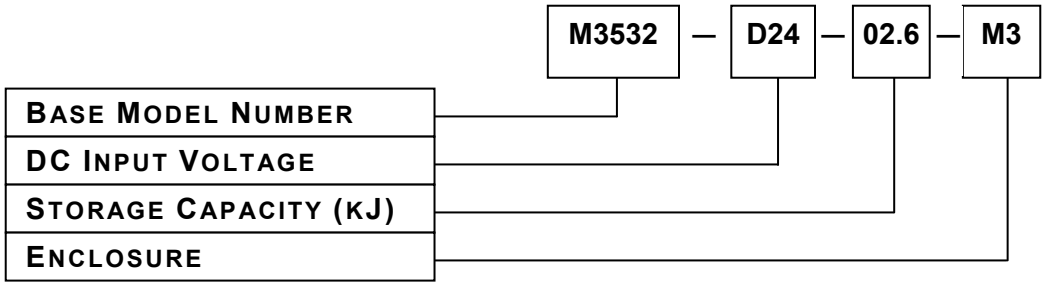
2. PRODUCT DESCRIPTION / FEATURES

The contactor RTM is designed with energy storage to support the contactor coil voltages during power outages that would normally allow the contactor to drop out, causing the field to generate a large voltage (V=L x di/dt) spike which could damage drive electronics or motor field.

2.1. RELATED DOCS

2.2. PART NUMBER BREAKDOWN

Figure 2-1: Example of Part Number Breakdown



BASE MODEL NUMBER

The Base Model Number for the Contactor Ride-Thru is M3532.

DC INPUT VOLTAGE RATING

The DC input Voltage Rating indicates the voltage level to be used to supply power to the M3532. The DC Input Voltage is indicated by the actual DC voltage. For example 24VDC is written as D24.

STORAGE CAPACITY

The Storage Capacity of the Ultra Caps for the unit is stated in kJ.

ENCLOSURE

The dimensions of the M3 Enclosure are 12”h x 3”w x 9”d.

2.3. GENERAL SPECIFICATIONS CHART

Table 2-1

PARAMETER	SPECIFICATION
System power	60 watts
Input Voltage	24VDC nominal, 27VDC max.
Input Current (while charging)	5 amps max
Output Voltage	24 - 10VDC
Output Current	2.5 amps
Ride -Thru	Ultra cap storage for 60 seconds @ 9.8 ohm load
I/O	24V input power Enable contact Current sensing input 24V coil output with Ride-Thru Dry "Ready" output contact rated @: 0.5A@125VAC, 1A@24VDC
Other characteristics:	Commutation diode provided Current Sensor provided Not CE certified Not UL Listed
Front Panel:	24V INPUT LED CAP VOLTAGE LED CAP READY LED FIELD CURRENT LED
Enclosure	Finger safe enclosure
Enclosure Dimensions:	12 x 3 x 9" (H x W x D)
Weight:	Less than 15 lbs
Cooling:	Natural convection
Storage Temp Range:	-20° to +65°C
Operating Tem Range:	0° to +40°C
Humidity:	95% Non-condensing
Altitude:	3000 ft

2.4. General Precautions and Safety Warnings

- High voltages may be present!
- 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.
- Always allow adequate time for residual voltages to drain (as indicated by the Cap Voltage LED) before removing the enclosure cover.
- **FAILURE TO HEED THESE WARNINGS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.**
- Certain components within this product may generate high surface 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 system 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. INSTALLATION INSTRUCTIONS

3.1. ENVIRONMENT

M3532 is designed for rugged dirty environments by using Dow 732 silicone on large components, Loctite to keep bolt connections from loosening, and Humiseal spray on circuit boards to prevent dirt and condensation from affecting electronic circuits.

3.2. 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 whom the product was purchased.

3.3. MOUNTING

3.3.1. CONTROLLER MODULE

Mounting should be done using #10/32 or ¼ 20 hardware (or equivalent metric-sized hardware). Use 4 mounting holes (outside holes) for high vibration environments, 2 mounting holes (middle holes) for factory installations. There should be a minimum of 2" on all sides of the module, and no heat source should be underneath. See Fig 6-1 for mounting dimensions.

3.3.2. CURRENT SENSOR MODULE

Mounting should be done using #8/32 or #10/32 hardware (or equivalent metric-sized hardware). Use 3 mounting holes for high vibration environments, 2 mounting holes (outside holes) for factory installations. Sensor Module may be mounted 16ft away from Controller Module. Mount the Current Sensor so that current between the contactor and supplied Commutation Diode passes through the Sensor. See Fig 6-2 for mounting dimensions.

3.3.3. DIODE MODULE

Mounting should be done using # 10/32 or ¼ 20 hardware (or equivalent metric-sized hardware). Use 4 mounting holes. Diode may not carry current full time so heat sinking may not be necessary. If physical space is an issue, and it is known that the diode will not have continuous current, it may be removed from the heatsink and mounted using the supplied heat pad or heat grease. The Diode should be mounted near the contactor, with the current flow from the contactor going through the supplied Current Sensor Module. See Fig 6-3 for mounting dimensions.

3.4. WIRING AND CUSTOMER CONNECTIONS

3.4.1. POWER WIRING

COMMUTATION DIODE SET UP:

ASM 3532-D236 is designed to carry the commutation current when the heating voltage is removed from the motor field under a power loss or sag event. The Diode should be connected upstream of the contactor so that it

is only connected to the motor field when the heating supply is used. The Current Sensor assy should be connected between the Diode and the motor field so that the motor field current passes through the Current Sensor as it commutates through the Diode. Anode should be connected to the negative side of the motor field, cathode to the positive side. See Figure 6-4.

The heatsink is provided to be sure the Diode does not overheat during the commutation period. Some applications may not need the heatsink.

Once properly installed the Diode requires no maintenance or adjustment.

3.4.1.1. SOURCE CONSIDERATIONS

The 24V source must be capable of supplying 5 amps as adjusted by the factory. Absolute maximum sustained input must be less than 27VDC to avoid risk of damaging Ultra Capacitors.

3.4.1.2. GROUNDING REQUIREMENTS

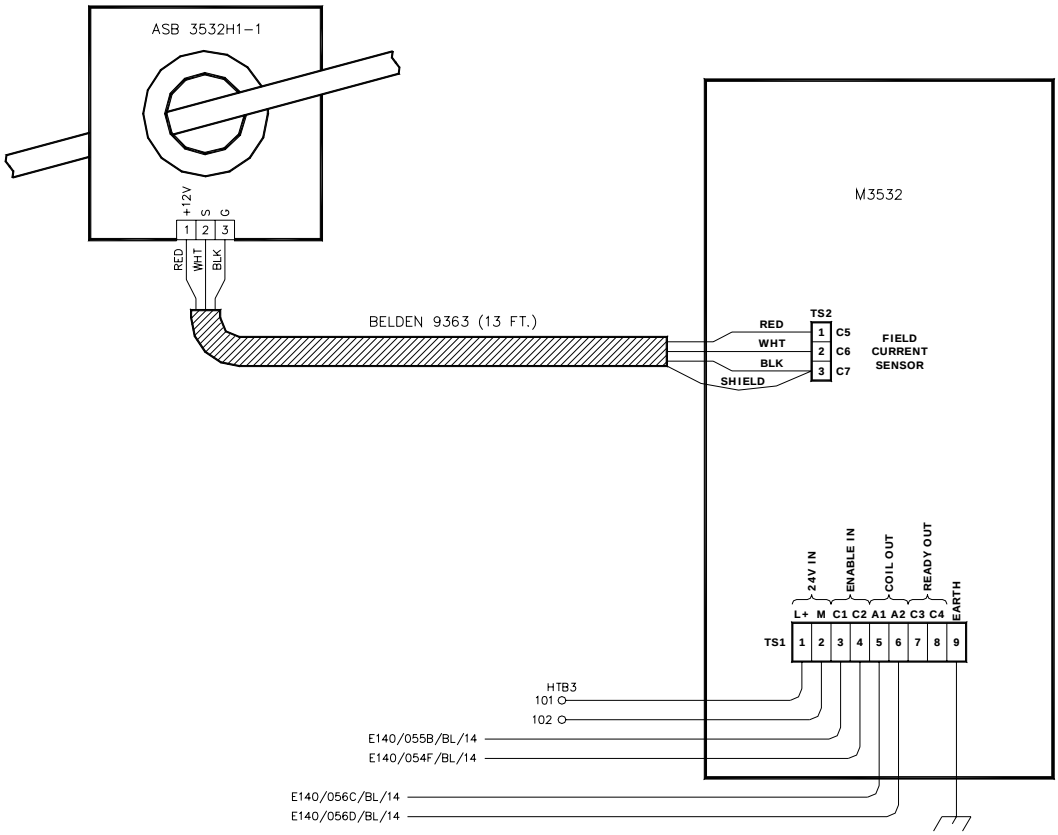
Earth ground connection is provided at TS1-9

3.4.2. CONTROL INTERFACE WIRING

The motor field current should pass through the Current Sensor in the proper direction for the system to operate properly. If there are over 4 amps of motor field current present, and the current passes through in the proper direction, the front panel FIELD CURRENT LED will illuminate. If the current passes through in the wrong direction the LED will not be ON, and the Controller will assume the motor field current is low and allow the contactor be turned on and off with the incoming enable signal. See Figures 6-2 and 6-4 for proper polarity.

Interconnection between the Current Sensor Module and the Controller Module can be made via the supplied cable. The shield should be connected to the M3532 Controller Module. See Figure 3-1 for interconnection details.

Figure 3-1: Typical Field Wiring



4. OPERATION

4.1. FUNCTIONAL DESCRIPTION

Input voltage to the Contactor Ride-Thru Module (CRTM) is 24VDC. At power-up the 24VDC is applied to the CRTM and an internal current source will charge the Ultra Caps in the module to approximately 24VDC. This typically takes 1-2 minutes. The CAP READY LED will illuminate when the cap bank has sufficient energy storage to ride through an event. A contact closure will be will be available for monitoring at that time.

A contact closure from an external source (PLC) can activate the main contactor coils at this time through an interposing relay in the CRTM. When the internal relay of the CRTM has been activated, 24VDC will be applied to the main contactor coil. After field current exceeds a minimum threshold level set in the Current Sensor Module (CSM), a hold-in contact bypasses the command contact from the PLC until field current drops below the threshold level again. If the source of the field current is reduced to zero without a power fault, the field contactor can be opened immediately by dropping the command contact, but if a power fault occurs dropping the field voltage source without ramping the current to zero, the field current will be commutated through the added commutating diode as long as the field contactor is held closed. The internal Ultra Caps of the CRTM provide the energy to maintain field contactor closure until the field current can decay naturally to the low limit value

set in the CSM. This typically takes about 5 time constants of the field. 1 TC = field inductance/field resistance.

4.2. FEATURES

4.2.1. TERMINAL STRIP I/O

Field connections to the M3532 can be found on the front of the Controller Module. TS1 is for system connections and TS2 is for interconnection with supplied Current Sensor Module. There is a Commutation Diode supplied that will be connected to the drive system separately from the Current Sensor and Controller Modules.

TS1:

- TS1-1 & 2 are for 24VDC input supply, positive to 1 and negative to 2. The 24VDC supply must be capable of at least 5 amps if caps are to be charged while contactor is pulled in.
- TS1-3 & 4 are for input enable contact. This contact is the signal used to pull in the main contactor for the motor field heater supply, and must be able to carry 100mA in a 12V circuit.
- TS1-5 & 6 are for the contactor coil output drive. This coil pull in voltage will be 0.5VDC below the incoming supply, and will be supplied when the input enable is closed, or the Current Sensor senses more than 4 amps of motor field current. The output is protected from short circuit by a PTCR device rated @ 3.75 amps.
- TS1-7 & 8 are for an auxiliary ready report contact to the system. This contact will be closed when the capacitor bank is fully charged and ready for a power outage.
    - Contact rating 0.5A@125VAC, 1A@24VDC.

Connections to TS1 may be made using 18 – 12awg wire.

TS2:

- TS2-1 is for +12v to the current sensor module
- TS2-2 is for the current sensor module signal back to the controller.
- TS2-3 is for the common return.

Connection between M3532 Controller TS2 and ASM 3532-CS100 Current Sensor is made using the supplied cable. Shielding is recommended and is included with the supplied connection cable.

4.2.2. INDICATORS

There are four indicators on the M3532 contactor Controller front panel.

1. 24V INPUT
    - This **red** LED will be illuminated when the externally supplied 24VDC is present.
2. CAP VOLTAGE
    - This **red** LED will be illuminated as the capacitor bank is charged. Intensity varies with capacitor voltage.
    - When the intensity is equal to the 24V input LED the cap bank is close to fully charged.

3. CAP READY
   - This **green** LED will be illuminated when the capacitor bank is charged to the level set by ready pot R43 (factory set for 23VDC). If the incoming voltage is not above 23.5VDC, this LED may not illuminate.
4. FIELD CURRENT
   - This **red** LED will be illuminated when the field current is above the set-point (factory set for 4 amps). If this LED does not illuminate, it indicates that the field current may not be passing through the Sensor in the proper direction, or that there is no field current.

4.3. STARTUP

4.3.1. PRE POWER CHECKS

Ensure all modules are properly secured. Double check all wiring to be sure DC polarities are correct. Ensure current flows through Sensor Module in the proper direction.

4.3.2. STARTUP PROCEDURE AND CHECKS

1. Apply 24V power to the M3532 Controller Module.
   - **24V INPUT** LED will illuminate immediately.
   - **CAP VOLTAGE** LED will begin to illuminate, increasing in intensity as cap voltage increases.
   - In approximately 2 minutes the **CAP READY** LED will illuminate.
   - The **Ready aux** contact should close.
2. Apply the enable signal to the 3532 Controller.
   - The field contactor should pull in.
3. Enable the field supply drive.
   - Once at least 4 amps are present in the field, the **FIELD CURRENT** LED should illuminate and the **green** LED on the Current Sensor Module should illuminate.
4. Unit is now ready to ride through a power loss or sag event.

4.4. OPERATIONAL ADJUSTMENTS

M3532 is designed to hold in the contactor coil during a power loss or sag event in order to prevent a voltage spike from destroying the motor when the contactor opens before the field current stops. The Controller accepts an enable command to energize the contactor, and will "hold in" the contactor during a power loss or sag event until the field current is reduced to a safe level through the Commutating Diode.

The M3532 Ride-Thru Controller Module has two internal adjustments; the Current Sensor has one.

THE READY LEVEL ADJUSTMENT

The front panel CAP READY LED shows when the Ultra Capacitors are close to fully charged. The ready adjustment is factory set to become "ready" with an Ultra Cap level of 23VDC.

- Turning pot R43 CW will increase the level to become ready, and CCW decreases the ready level.
- If the incoming supply is not over 23.5VDC, the CAP READY LED may never become lit.
- If the CAP READY LED is not lit, the controller will still have some ride through capability, depending on the state of cap bank charge.

THE CHARGE CURRENT ADJUSTMENT

The front panel CAP VOLTAGE LED indicates the level of charge. The intensity will vary with cap voltage. The charge current is factory set for 2 amps, and can be varied between 1 and 2.4 amps. The capacitor bank will be fully charged in approximately 2 minutes with a 24V supply and a 2 amp set-point. Less time is required if the cap bank is not completely discharged.

- Turning pot R30 CW will increase the charge current, and CCW will decrease the charge current.

CURRENT SENSOR ADJUSTMENT

ASM 3532-CS100 is designed to measure the field current, and give feedback to the M3532 Controller so that the contactor cannot be opened until the current is below a dangerous value. This is factory set for both the FIELD CURRENT LED on the Controller and the LED on the Current Sensor to turn on at 4 amps, and off at 2.5 amps. These settings will lower slightly as temperature decreases.

Adjustment can be made on the Current Sensor Module by turning the “trip level” pot R3.

- CW increases drop out level
- CCW to decrease drop out level.
- Adjustment changes setting by approximately 1 amp per turn.
    - Decreasing drop-out level below 2 amps may cause the Sensor to become latched in the ON state, and not allow the field contactor to drop out!

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

Yearly periodic testing of ride through capability is recommended for critical applications. Testing can be done without danger to the motor field by removing the plug from TS2, and connecting the +12v at TS2-1 (C5) to the signal input at TS2-2 (C6) Current Sensor input terminals. This simulates current flow in the field, and should illuminate the FIELD CURRENT LED. Enable the M3532 controller and allow the caps to charge until the CAP READY LED comes on. Then remove the 24V input, and the enable, and the M3532 Controller will hold in the contactor until it drops out, or until the internal relay drops out, which is about 6VDC on the coil output at TS1-5 & 6.

5.2. MAINTENANCE ITEMS

Model M3532 does not contain any items in need of periodic maintenance. Although there is no forced airflow, cleaning of the unit in dirty environments may still be necessary. Checking for loose screws or components in high vibration environments may also be considered.

5.3. TROUBLESHOOTING

SYMPTOM	ACTION
No 24V INPUT LED	• Check for 24VDC at input to Controller module o Replace 3532 Controller if present
No CAP VOLTAGE LED	• Ensure 24VDC INPUT LED is ON • Allow several seconds for the cap voltage to charge above 6VDC o Replace 3532 controller if CAP VOLTAGE LED never turns on
No CAP READY LED	• Ensure enough time has passed for the cap bank to charge • Check that incoming supply is above CAP READY set-point o Factory set for 23VDC • Ensure incoming supply has enough current capability to charge the cap bank o Turn enable off while charging
No FIELD CURRENT LED	• Check that current flows through current Sensor module in the proper direction. • Ensure the cable between Current Sensor assembly and Controller Module is properly connected and screwed in • Ensure the Controller has been enabled • Ensure there is actual current flow through field
Contactor never pulls in	• Check for enable input to Controller • Check output for 24VDC • Check for excessive load on output (PTCR limited to 3.75 amps)
24V supply drops when connected to controller	• Contactor and cap charging load may be too much for supply o Turn off enable until CAP READY LED turns on • Lower charge current level

6. ENGINEERING DATA

6.1. WATT LOSS

The complete M3532 system uses approximately 3 watts once charged.

6.2. FUSE/CIRCUIT BREAKER SIZING AND RATING

Input fuse, circuit breaker or current limited source should be 5 amps.

The 24V output to the field coil contactor is protected by a PTCR re-settable fuse rated @ 3.75 amps.

6.3. DIMENSIONS AND MECHANICAL DRAWINGS

Figure 6-1: M3532 Controller Dimensional Outline

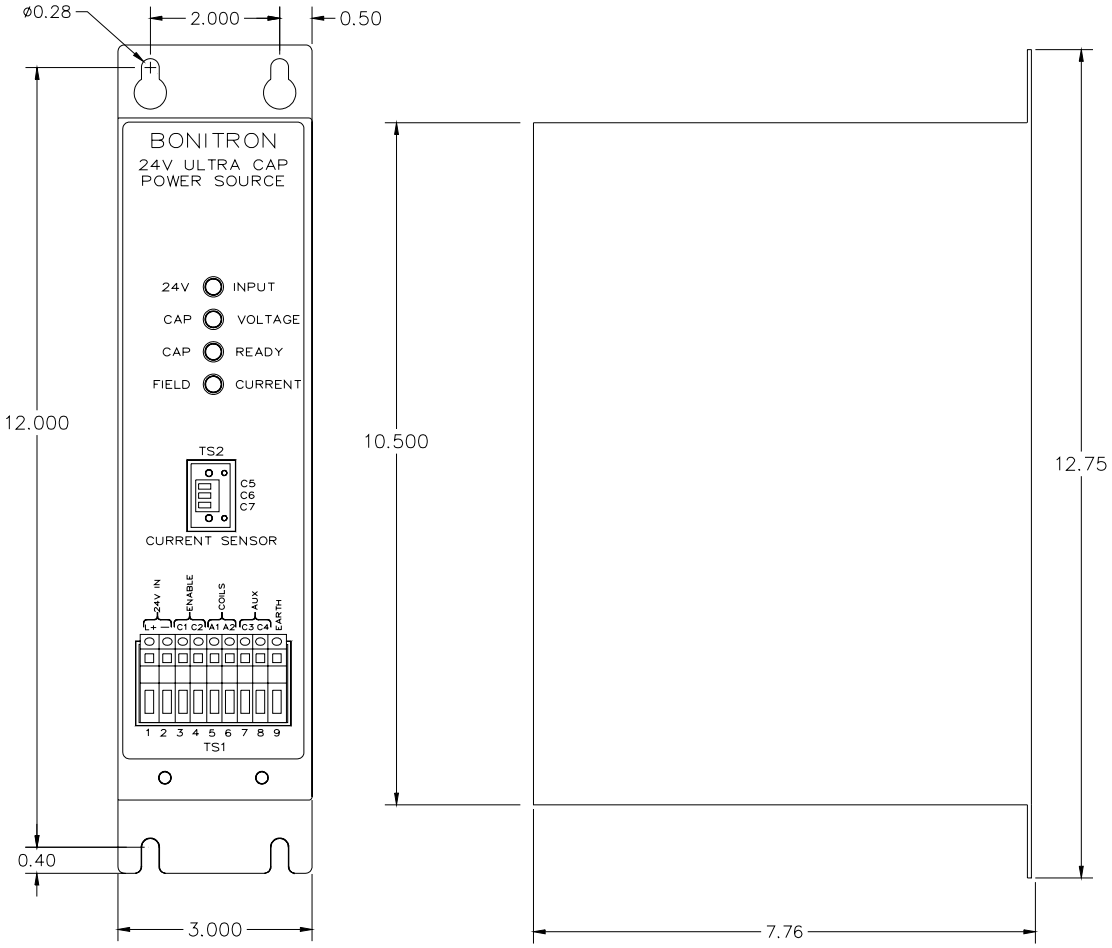


Figure 6-2: Current Sensor Dimensional Outline

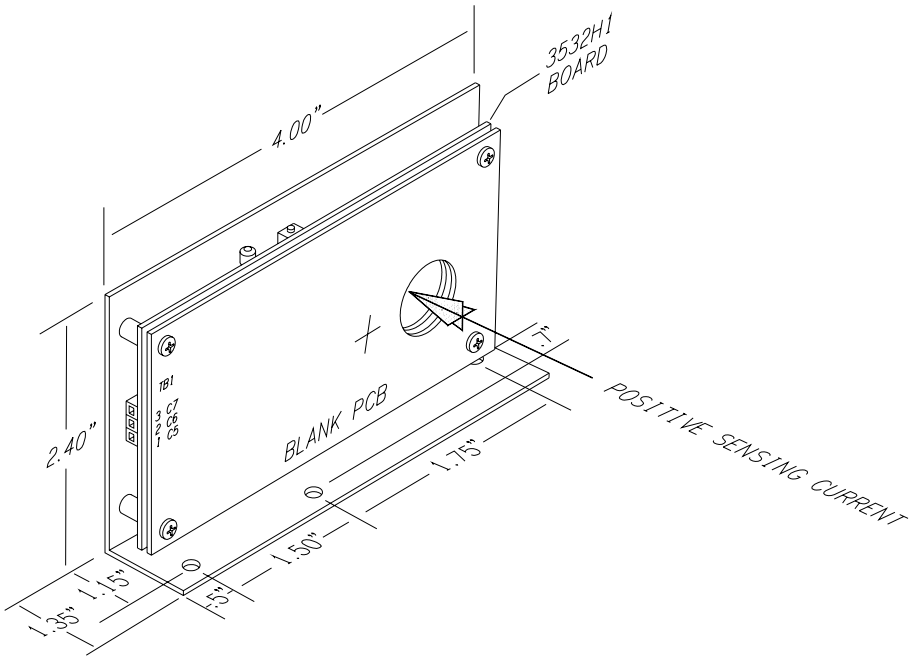
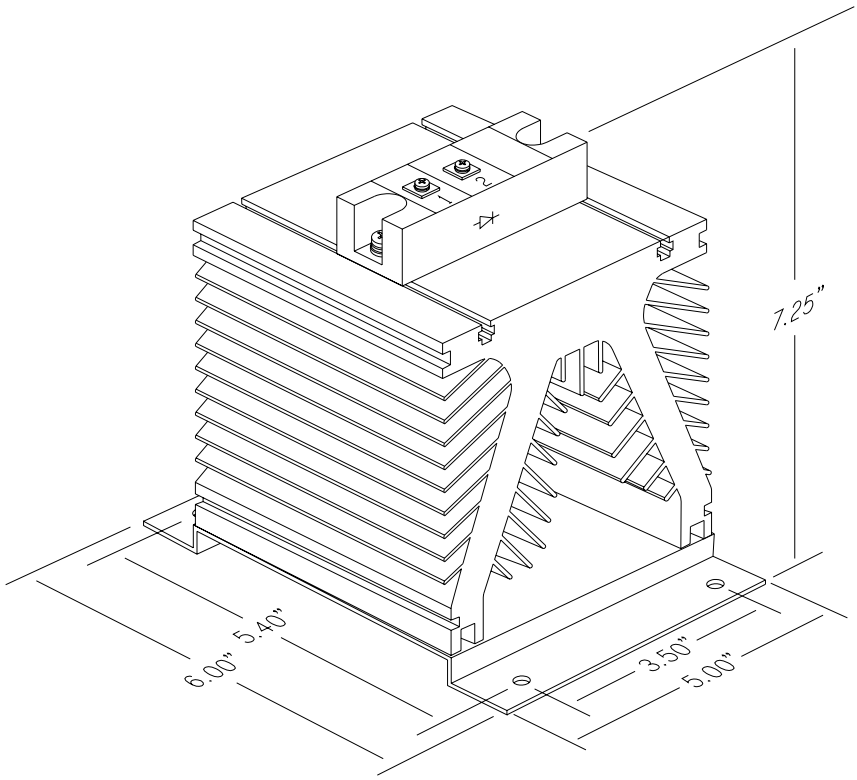


Figure 6-3: Diode Dimensional Outline



6.4. BLOCK DIAGRAMS

Figure 6-4 shows a typical system block diagram. Figure 6-5 shows the simple schematic of the system. The location and polarity of the Current Sensor Module must be correct to be able to provide the lock-in for the main contactor and turn on the front panel LED.

Figure 6-4: M3532 Contactor Ride-Thru Module (CRTM) System Block Diagram

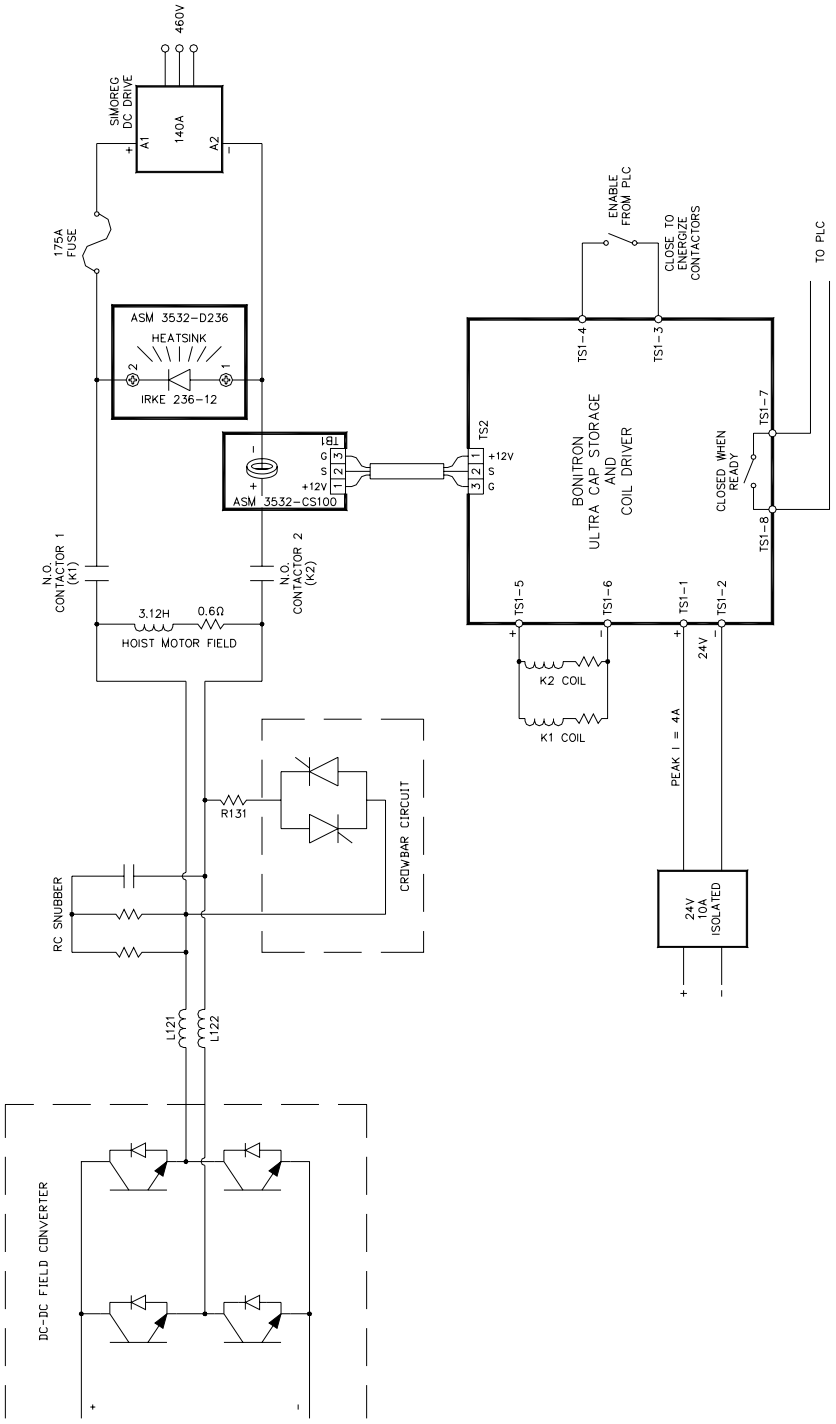
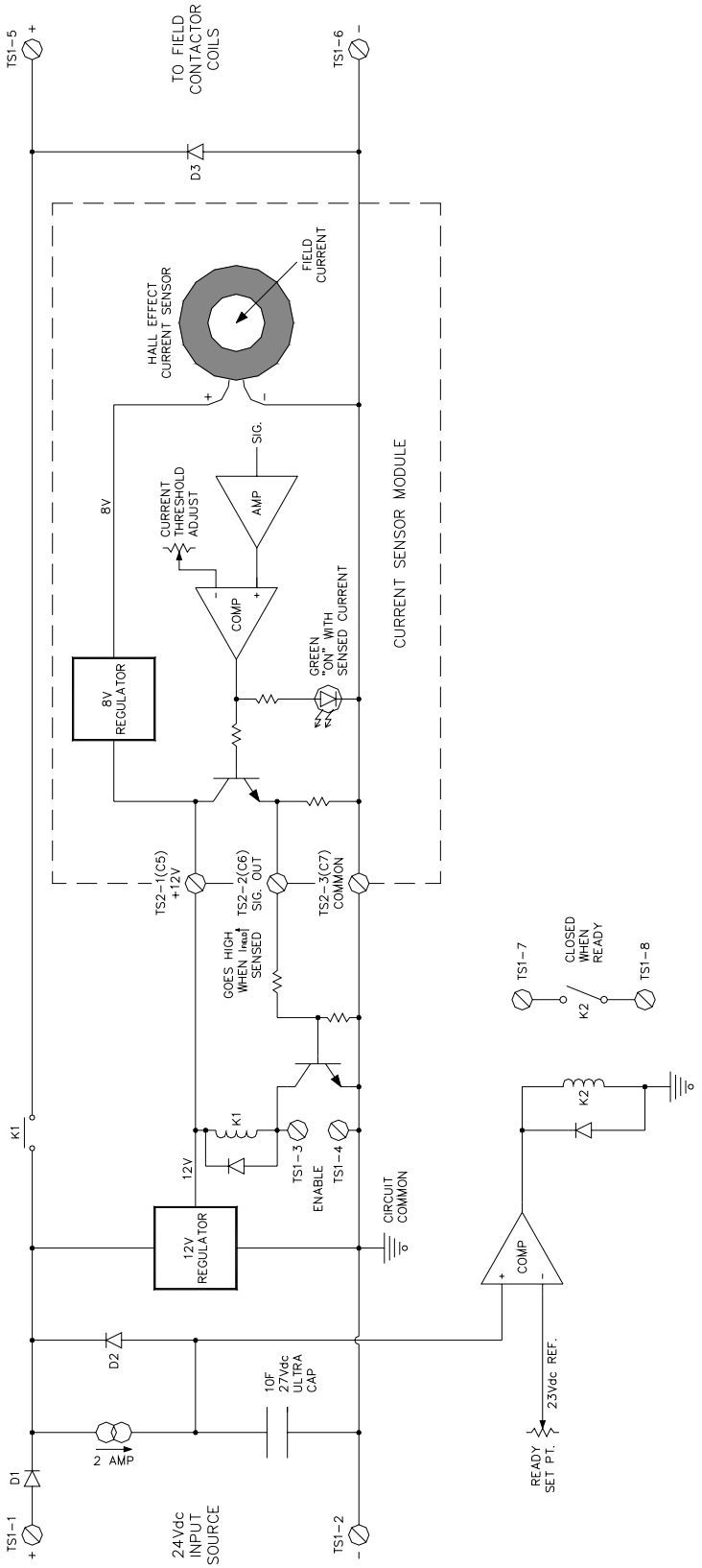


Figure 6-5: M3532 Contactor Ride-Thru Module Simple System Schematic



6.5. PARTS LIST

Field-replaceable parts include:

M3532-D24-2.6KJ-M3 CONTACTOR RIDE-THRU CONTROLLER MODULE

NUMBER	DESCRIPTION /REV	QTY
ASB 3532C1-1	Control Board	1
LBL 3532-M3	080113: Label For M3532 M3 Chassis	1
LD CM-5100H1	Chicago Mini: 5100h1 Red Pnl Mounted w/Pigtail	2
LD CM-5100H3	Chic Min 5100H3: Amber Lamp	1
LD CM-5100H5	Chicago Mini: 5100h5 Grn Pnl Mounted w/Pigtail	1
TS MC-DFK-3	Phoenix 1829358 Mini Combi 3 Pol Header	1
TS MC-STF-3	Phoenix 1827716 Mini Combi 3 Pol Plug/Header With Screws	1
TS RW-EK2.5	Weid #0474360000: 27A Ground Terminal	1
TS RW-SAK2.5	Weid #027966: 25A Terminal	8

ASM 3532-CS100 CONTACTOR RIDE-THRU CURRENT SENSOR MODULE

NUMBER	DESCRIPTION /REV	QTY
ASB 3532H1-1	Current Sensor Board	1

ASM 3532-D236 CONTACTOR RIDE-THRU DIODE MODULE

NUMBER	DESCRIPTION /REV	QTY
DI-IRKE-236/12	Commutation Diode	1

6.6. RECOMMENDED SPARE PARTS

The following items are not stock items and should be kept as spares, depending on the importance of their place in the system.

NUMBER	DESCRIPTION /REV	QTY
ASB 3532C1-1	Control Board	1
ASB 3532H1-1	Current Sensor Board	1