

SPECIFICATIONS - CPU MODULES



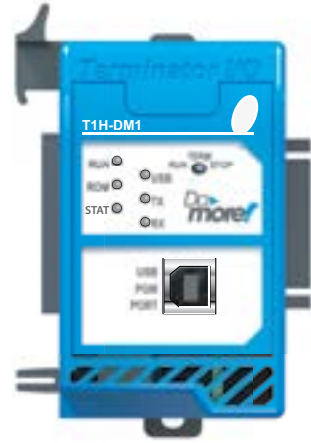
CHAPTER 3

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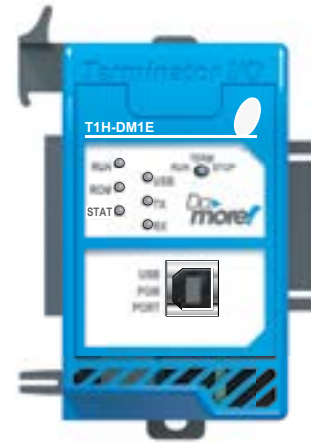
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CPU Specifications

CPU General Specifications		
Feature	T1H-DM1	T1H-DM1E
Total Memory (bytes)	262,144 bytes	
Ladder Memory (instruction words)	65,536 instruction words	
V-Memory (words)	Configurable up to 65536 (4096 default)	
Non-volatile V Memory (words)	Configurable up to 65536 (4096 default)	
D-memory (DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile D Memory (DWORDs)	Configurable up to 65536 (4096 default)	
R-memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Non-volatile R Memory (REAL DWORDs)	Configurable up to 65536 (4096 default)	
Boolean execution	50µs	
Stage Programming	Yes	
Number of Stages	128 per Program code-block; number of code-blocks configurable to memory limit	
Handheld Programmer	No	
Programming Software for Windows	FREE Do-more Designer	
Built-In communications ports	USB, RS-232	USB, RS-232, Ethernet (10/100 Base-T)
Program Memory	Flash ROM	
Total I/O points available	X, Y, each configurable up to 65536 (2048 default); WX, WY (analog in/out) each configurable up to 65536 (256 default)	
Max Number of Local I/O Modules	16	
Local I/O points available	256	
Ethernet I/O Discrete points	131,072	
Ethernet I/O Analog I/O Channels	32,768	
Max Number of Ethernet slaves per PLC	16	
I/O points on Ethernet I/O	32,768	
Discrete I/O Module Point Density	8/16	
Number of instructions available	>160	>170
Control relays	Configurable up to 65536 (2048 default)	
Special relays (system defined)	1024	
Special registers (system defined)	512	
Timers	Configurable up to 65536 (256 default)	
Counters	Configurable up to 65536 (256 default)	
System Date/Time structures	8	



T1H-DM1



T1H-DM1E

CPU General Specifications (continued)		
Feature	T1H-DM1	T1H-DM1E
User Date/Time structures	Configurable up to 65536 (32 default)	
ASCII String/Byte buffer structures	Configurable up to memory limit (192 default)	
Modbus Client memory	Yes, configurable up to memory limit, default 1024 input bits, 1024 coil bits, 2048 input registers, 2048 holding registers	
DL Classic Client memory	Up to memory limit, default 512 X, 512 Y, 512 C, 2048 V	
Immediate I/O	No	
Interrupt input (hardware / timed)	No	
Subroutines	Program and Task code-blocks, up to memory limit	
Drum Timers	Yes, up to memory limit	
Table Instructions	Yes	
Loops	FOR/NEXT, WHILE/WEND, REPEAT/UNTIL loops	
Math	>60 operators and functions: Integer, Floating Point, Trigonometric, Statistical, Logical, Bitwise, Timing	
ASCII	Yes, IN/OUT, Serial, Ethernet TCP and UDP; 11 output script commands	
PID Loop Control, Built In	Yes, configurable to memory limit (over 2,000)	
Time of Day Clock/Calendar	Yes	
Run Time Edits	Yes	
Supports True Force	Yes	
Internal Diagnostics	Yes	
Password security	Multi-user, credentialed, session-based security	
System error log	Yes	
User error log	Yes	
Battery backup	Yes (Battery included)	



Do-more Designer V1.2 or newer must be used with these Do-more T1H CPU modules.

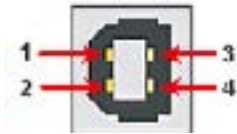
Communications Ports Specifications

Port 1 Specifications (USB)

USB Port: This port has a USB Type B female connector and requires a USB Type A-B cable.

- Do-more programming protocol only

USB Type B Slave Input Specifications	
Description	Standard USB 2.0 Slave input for programming and online monitoring only, with built-in surge protection. Not compatible with older full speed USB devices.
Cables (ADC part #)	USB Type A to USB Type B: USB-CBL-AB3 (3ft) USB-CBL-AB6 (6ft) USB-CBL-AB10 (10ft) USB-CBL-AB15 (15ft)



USB Port 1		
1	5V	Bus Voltage Sense
2	D-	Data -
3	D+	Data +
4	0V	Ground

Port 2 Specifications (Serial)

RS-232 Port: Serial RS-232 multipurpose communications port:

- Full-duplex
- 1024B buffer
- RJ-12 connector

RJ-12 style connector used for:

- Do-more programming protocol
- Modbus RTU Master connections
- Modbus RTU Slave connections
- ASCII Incoming and Outgoing communications
- Custom Protocol Incoming and Outgoing communications

RS-232 Specifications	
Description	Non-isolated, full duplex RS-232 DTE port used for programming, online monitoring or can connect the CPU as an ASCII or Modbus RTU master or slave to a peripheral device. Includes ESD and built-in surge protection.
Communications	1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 Baud
+5V Cable Power Source	220mA maximum at 5V, ±5%. Reverse polarity and overload protected.
Maximum Output Load (TXD/RTS)	3kΩ, 1,000pf
Minimum Output Voltage Swing	±5V
Output Short Circuit Protection	±15mA
Cable Options	D2-DSCBL USB-RS232 with D2-DSCBL FA-CABKIT FA-ISOCAN for converting RS-232 to isolated RS-422/485 EA-MG-PGM-CBL



RS-232 Port 2		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection (220mA max)
3	RXD	Receive Data (RS-232)
4	TXD	Transmit Data (RS-232)
5	RTS	Request to Send (RS-232)
6	CTS	Clear to Send (RS-232)

Port 3 Specifications (Ethernet)

Ethernet Port: Programming and Modbus TCP Client/Server port with 10/100 Base-T Ethernet RJ45 connector.

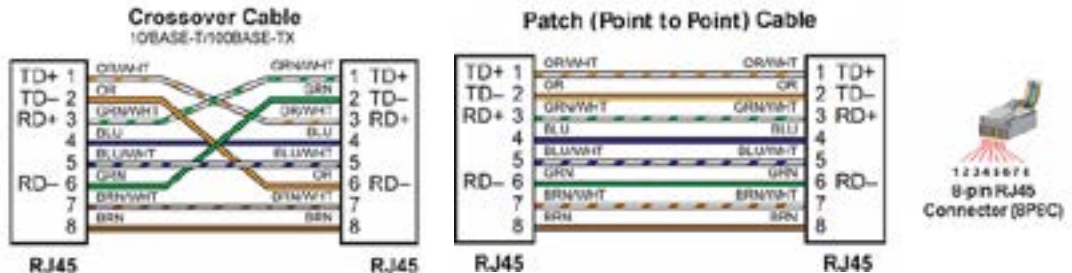
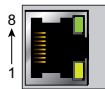
RJ-45 style connector used for:

- Do-more programming protocol
- Modbus TCP Client connections (Modbus requests sent from the CPU)
- Modbus TCP Server connections (Modbus requests received by the CPU)
- Ethernet I/O Master

Ethernet Specifications	
Description	Standard transformer isolated Ethernet port with built-in surge protection for programming, online monitoring, Modbus/TCP client/server connections (fixed IP or DHCP) and Ethernet I/O capabilities.
Transfer Rate	10/100 Mbps
Cables	Use a Patch (Point to Point) cable when a switch or hub is used. Use a Crossover cable when a switch or hub is not used.



NOTE: The Ethernet port can support all the functions listed above at the same time. However, it is important to consider the implications to network traffic and network topology. Since there is just one Ethernet port available, it will not be possible to use multiple functions and have an isolated network for Ethernet I/O, as is recommended. Utilize the adjustable poll rates of Ethernet I/O and Modbus TCP Clients (if auto-polling) to limit the impact on your network.



NOTE: The above diagram illustrates the standard wire positions in the RJ45 connector. It is recommended that all 10/100 Base-T cables be Category 5, UTP cables.

Ethernet I/O

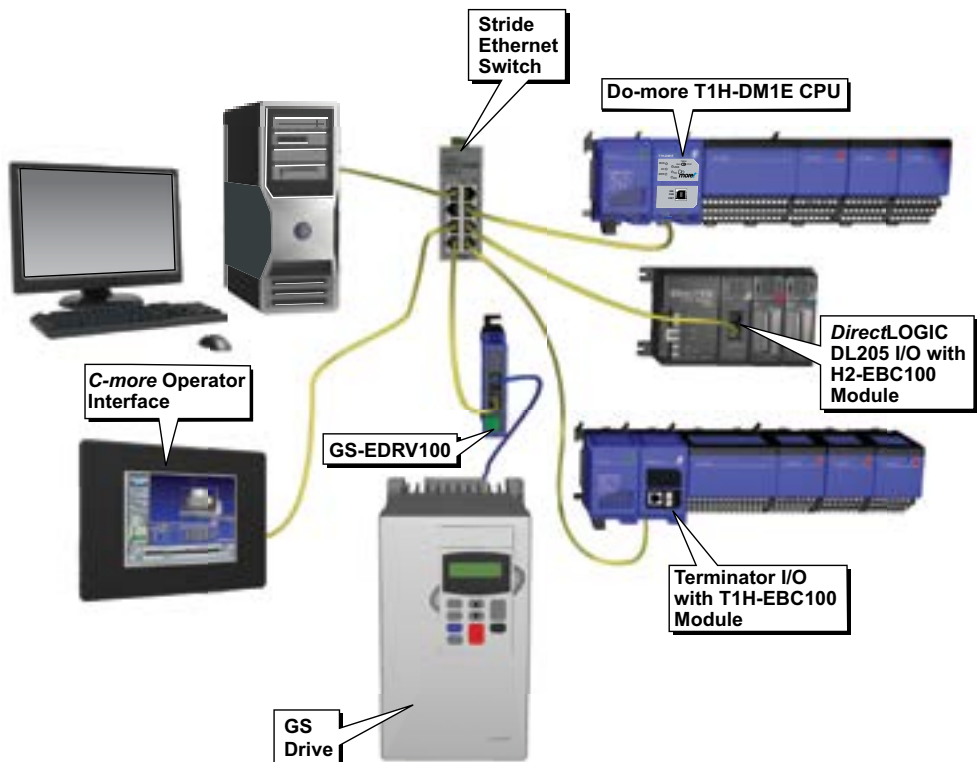
The T1H-DM1E CPU's built-in Ethernet port can be configured as an Ethernet I/O master. The Ethernet I/O feature allows expansion beyond the local chassis to slave I/O using the onboard high-speed Ethernet link.

The onboard Ethernet port can support up to 16 slave devices. The slave I/O modules supported are:

- H2-EBC100
- 1H-EBC100 (Terminator I/O)
- GS-EDRV100 (GS Drives)

The Ethernet I/O network uses Category 5 UTP cables for cable runs up to 100 meters (328 ft.) with extended distances achieved through Ethernet switches.

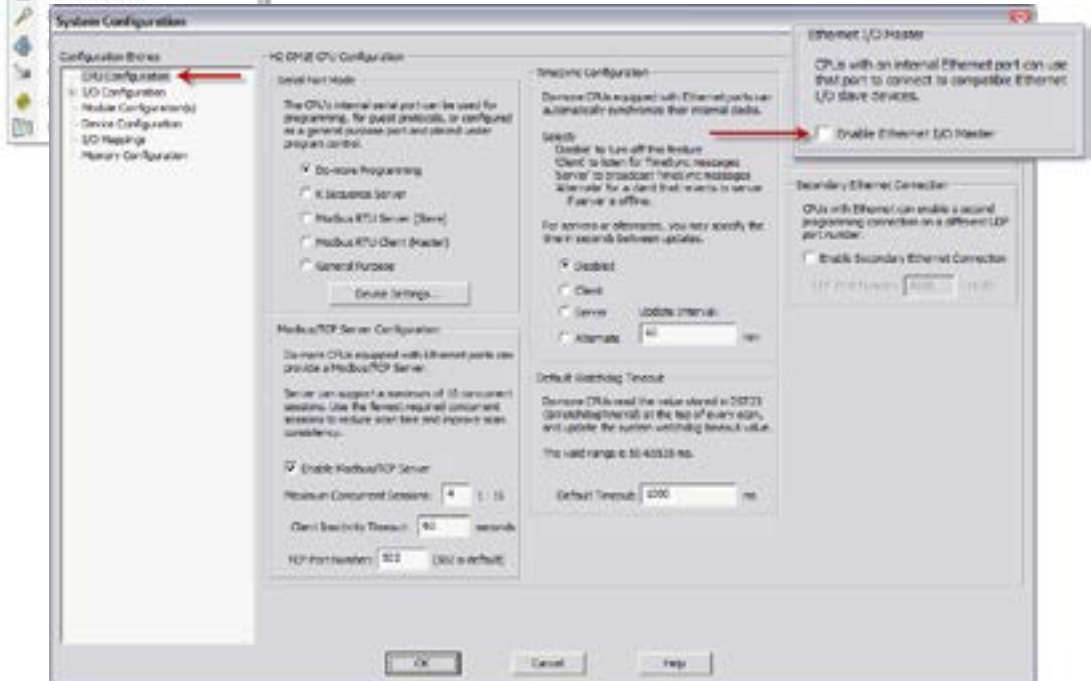
Ethernet I/O Example





Ethernet I/O functionality is enabled through the System Configuration dialog of Do-more Designer.

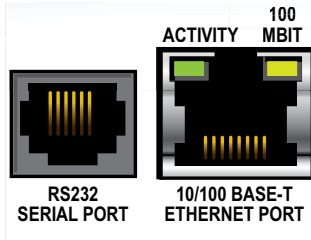
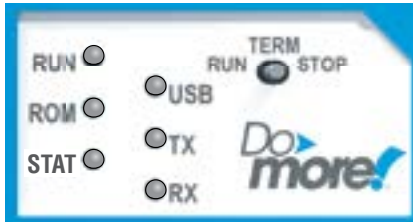
Under the PLC drop down menu, select System Configuration. Then, from the System Configuration window select the CPU Configuration option under the Configuration Entries column. Finally, left-click the Enable Ethernet I/O Master checkbox in the Ethernet I/O Master section of the T1H-DM1E CPU Configuration window as seen below.



For more information on the setup, use and options available with Ethernet I/O, refer to the Ethernet I/O Master section of Do-more Designer Help File topic DMD0247.

Status Indicators

Do-more T1H CPU modules have multi-color LEDs that are used to visually provide operational status to the user.



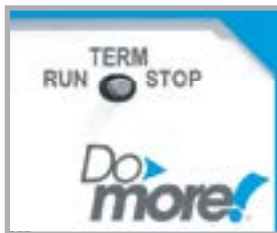
LED Indicators		
Indicator	Status	Description
RUN	Green	CPU is in RUN Mode
	Yellow	Forces are Active
ROM	Yellow	CPU is updating Non-volatile Memory
STAT*	Red*	CPU Fatal Error
	Yellow	Low Battery
	Green	Status OK (good)
USB	Green	USB Receive Activity
	Yellow	USB Transmit Activity
TX	Green	RS-232 Transmit Activity
RX	Green	RS-232 Receive Activity
ACTIVITY	Green	Ethernet Port Activity
100 MBIT	Yellow	Ethernet Port communicating at 100 MBIT Rate

* See Do-more software manual to further investigate what type of error has occurred.

In addition to the individual definition of each LED, there are times when the controllers will use combinations of the LED ON/OFF state and colors to convey status information. The following combinations use some or all of the LEDs:

- STAT LED is blinking RED for (15 seconds) - Do-more Designer can blink the STAT LED for 15 seconds to verify that a communication link is targeting the correct controller.
- All six (6) of the LEDs are ON and the color of each LED is GREEN - indicates the operating system has started running.
- All six (6) of the LEDs are cycling through RED and GREEN, in a circular 'chase' pattern - indicates the operating system is initializing.
- The left-most three (3) LEDs are cycling through RED and GREEN, in a 'bouncing ball' pattern - indicates the controller is running only the boot loader and is NOT going to load and run the operating system. The most likely cause is having DIP switch #1 in the ON position.
- All six (6) of the LEDs are ON and the color of each LED is RED - indicates the hardware watchdog timer has expired because the controller's operating system has stopped running.

Mode Switch Functions



Mode Switch Functions	
Mode Switch Position	CPU Action
RUN (Run Program)	CPU is forced into RUN Mode if no errors are encountered.
TERM (Terminal)	RUN, PROGRAM and the DEBUG modes are available. In this mode, the mode of operation can be changed through the Do-more Designer Software.
STOP (Stop Program)	CPU is forced into STOP Mode.

As mentioned in the previous table, the CPU mode can also be changed through the programming software if the mode switch is placed in the TERM position. In this position, the CPU can be changed remotely between the Run and Program modes. For more information on changing CPU modes through the software, see the “Step 9: Write Project to the Do-more PLC” section of Chapter1 “Getting Started”.

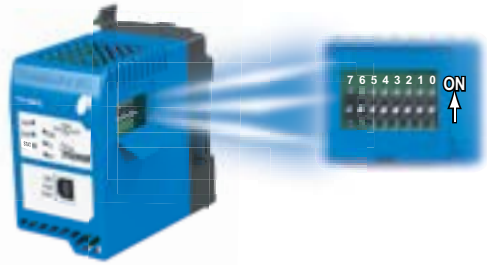
When power is applied to the system, the controller will go through it’s power-up sequence then either stay in Program mode if the mode switch is in the STOP position, or attempt to go to Run mode if the mode switch is in the RUN position.

If the mode switch is in the TERM position, the controller will return to the last operational mode before power was lost. For example, if the controller was in Run mode when power was lost, when power is restored and the mode switch is in the TERM position, the controller will attempt to return to Run mode.

DIP Switch Specifications

Do-more controller’s circuit board has a block of DIP switches that are used to perform various debug and reset operations. The DIP switch settings are only read when the system is first powered up. Changing the settings of the DIP switches requires that the system containing the controller be powered down and the CPU removed. The DIP switches can then be changed as required. The DIP switch block is located on the right side of the CPU under a small cover. Once the switches have been set, the CPU can then be reinstalled in the system and powered back up.

The default position for all of the DIP switches is OFF. The table below describes the position and function associated with each DIP switch.



DIP Switch Settings		
Switch Number	Switch Position	Function
0	ON	Load the last copy of the operating system.
1	ON	Do not load an Operating System, stay in the Booter.
2	ON	Disable the hardware watchdog timer - the hardware watchdog is always enabled, but this switch allows the user to override the ability of the Force Watchdog Error (WATCHDOG) and Debug Mode to generate a Watchdog condition.
3	ON	Disable ability to update the firmware and/or gate array.
4	ON	Reserved
5	ON	
6	ON	
7	ON	Reset the TCP/IP Network Settings to factory default values - Must be used with DIP #1
All 8	ON	Clears everything from the controller (see details in the following pages)

Do-more T1H controllers make use of combinations of DIP switch settings and the Mode switch on the front of the controller to perform two reset functions. These reset functions can only be performed when the controller is in the boot loader.

The following sequence describes the steps necessary to perform one of the reset operations. This combination of DIP switch settings and mode switch manipulation is purposely complex to prevent these reset operations from being accidentally executed.

Clear only the Network Settings

This reset function will clear ONLY the Network settings, which consists of the Module ID, Module Name, Module Description, IP Address, Subnet Mask and Gateway Address.

1. Begin by powering down the controller.
2. Remove the controller from the base and record the location of the DIP switches (so they can be set back to their original position after the manual reset is finished).
3. Next set ONLY DIP #1 and #7 ON to perform the Clear Only the Network Settings operation, make sure all other DIP switches are OFF.
4. Reinstall the controller in the base.
5. Set the controller mode switch to TERM (the center location) and power up the controller.
6. At this point the LEFT bank of 3 LEDs should be blinking the 'stay in the boot loader sequence', that is, they should be blinking in sequence, from top to bottom then back to the top, alternating between red and green.
7. Move the controller mode switch to RUN (to the left).
8. Move the controller mode switch to TERM (to the center).
9. Move the controller mode switch to RUN (to the left).
10. Move the controller mode switch to TERM (to the center).
11. Move the controller mode switch to STOP (to the right).
12. Move the controller mode switch to TERM (to the center) - the LEFT bank of 3 LEDs should now be ON.



NOTE: If you want to terminate the reset at this point you can do so by moving switch to RUN instead of STOP or powering down the controller.

- Move the controller mode switch to STOP (to the right) - the RIGHT bank of 3 LEDs should now be ON.



NOTE: If you want to terminate the manual reset at this point you can only do so by powering down the controller.

1. Move the controller mode switch to TERM (to the center) - the LEFT bank LEDs begin flashing the power up sequence, and the ROM led should briefly be ON indicating that the data in the ROM is being rewritten. The LEDs will then begin flashing the 'staying in boot loader' sequence indicating the reset is complete.
2. Power down the controller.
3. Remove the controller from the base and return the DIP switches to their original positions.
4. Set the controller mode switch to TERM (in the center location).

Clear All

This reset function will clear everything from the controller, this includes the Network Settings as described previously, and the System Configuration, Memory Configuration, all control logic, all Documentation, and all of the User Accounts and Passwords.

1. Begin by powering down the controller.
2. Remove the controller from the base and record the location of the DIP switches (so they can be set back to their original position after the manual reset is finished).
3. Next set all eight of the DIP switches ON to perform the Clear All operation.
4. Reinstall the controller in the base.
5. Set the controller mode switch to TERM (the center location) and power up the controller.
6. At this point the LEFT bank of 3 LEDs should be blinking the 'stay in the boot loader sequence', that is, they should be blinking in sequence, from top to bottom then back to the top, alternating between red and green.
7. Move the controller mode switch to RUN (to the left).
8. Move the controller mode switch to TERM (to the center).
9. Move the controller mode switch to RUN (to the left).
10. Move the controller mode switch to TERM (to the center).
11. Move the controller mode switch to STOP (to the right).
12. Move the controller mode switch to TERM (to the center) - the LEFT bank of 3 LEDs should now be ON.



NOTE: *If you want to terminate the reset at this point you can do so by moving switch to RUN instead of STOP or powering down the controller.*

- Move the controller mode switch to STOP (to the right) - the RIGHT bank of 3 LEDs should now be ON.



NOTE: *If you want to terminate the manual reset at this point you can only do so by powering down the controller.*

1. Move the controller mode switch to TERM (to the center) - the LEFT bank LEDs begin flashing the power up sequence, and the ROM led should briefly be ON indicating that the data in the ROM is being rewritten. The LEDs will then begin flashing the 'staying in boot loader' sequence indicating the reset is complete.
2. Power down the controller.
3. Remove the controller from the base and return the DIP switches to their original positions.
4. Set the controller mode switch to TERM (in the center location).

Battery Replacement

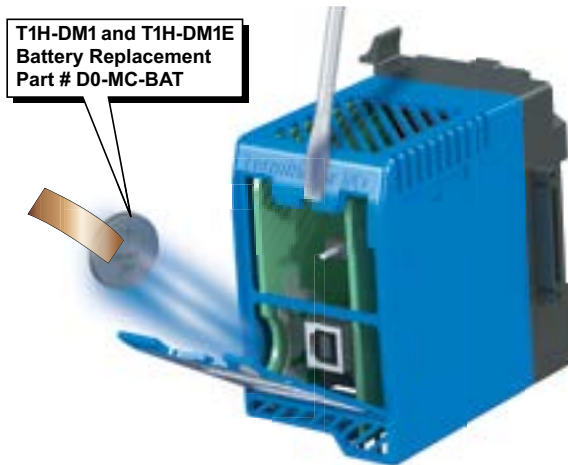
All Do-more controllers have an onboard battery that maintains the contents of the retentive memory any time the power to the controller is lost. The battery has an expected lifespan of three years; after which the battery will need to be replaced. The battery is a standard CR2032, coin cell battery. AutomationDirect part number: D0-MC-BAT.

When the controller detects that the battery voltage is too low, and needs to be replaced, the ERR LED will be YELLOW. When Do-more Designer is online with the controller, the system-defined location \$BatteryLow will be ON as well.



NOTE: Make sure to have a current copy of the Do-more Designer project saved to Disk before performing this operation.

1. Power down the system containing the controller.
2. Remove the controller from the system.
3. Pry open the front cover and remove the battery from it's holder that is located in the lower left corner. The battery is removed by pushing on the back of the battery to begin sliding it out of the holder, then pulling it the rest of the way out by the front edge of the battery. Make note of how the battery is aligned in the holder.



NOTE: The controller has an onboard capacitor that will maintain the retentive memory contents while the battery is being replaced. This capacitor has a two-hour runtime (minimum), which should be more than enough to replace the battery.

1. Insert the new battery into the holder, making sure the alignment is correct, and close the cover.
2. Reinstall the controller in the system.
3. Power up the system containing the controller.
4. Verify that the ERR LED is not YELLOW and the system-defined location \$BatteryLow will be OFF.