T100MD1616+ to FMD1616-10 Upgrade Notes

The FMD1616-10 is designed to be a replacement for the T100MD1616+ but with more high- precision analog I/O and of a 10/100Mbps Ethernet port. As a result there are differences that have to be taken into consideration when upgrading your current design from T100MD1616+ to FMD1616-10.

A. Is FRAM-RTC Required?

The first thing to check is whether you need to buy the FRAM-RTC together with your FMD1616-10. An important difference to consider when upgrading a *basic* (i.e. without all the add-on options) T100MD1616+ PLC to an FMD1616-10 is that the *basic* FMD1616-10 has only 1000 words of DM: from DM[1] to DM[1000], and there is no built-in EEPROM. However, the FMD1616-10 does have 1024 words of RAM-shadowed Flash memory that acts like a pseudo EEPROM, only that the software needs to execute a special command to save the content to the flash memory for permanent storage.

The optional **FRAM-RTC** module adds a battery-backed real-time clock to the FMD PLC (just like what MX-RTC does for the T100MD+ PLC), extends the DM from DM[1001] to DM[4000], and adds 11K words of non-volatile FRAM memory (equivalent to an extremely fast EEPROM).

Therefore, you will need a FRAM-RTC if any of the following applies to your current application:

1) You need to use DM[1001] to DM[4000] and these cannot be moved down to DM[1] to DM[1000] through a code rewrite.
2) You need more than 1024 words of EEPROM for data storage, or you need to regularly write to the EEPROM memory for data logging purpose.
3) You need a battery-backed real time clock to keep the time when the PLC is powered off.

B. Analog I/O Connection

The FMD1616-10's digital I/Os are designed to be drop-in replacement for T100MD1616+ PLC.

However, when designing the FMD1616-10 we weighed the pros and cons of either providing same analog I/O interface as the T100MD1616+ to allow near drop-in replacement, or providing more analog I/O with industry standard 0-5V or 0-10V interface but abandon the true compatibility with the old design.

In the end it was decided that keeping the same analog I/O interface and connector across all the FMD PLC and F-series PLC outweighs the benefit of keeping to true compatibility to the T100MD1616+. Hence users should note the important differences when upgrading to FMD1616-10:

1) T100MD1616+ uses two banks of screw terminals for all its analog I/O, whereas the FMD1616-10 uses a single DB15 connector for all its analog I/Os. A DB15 solder tail connector is shipped with each FMD1616-10 PLC.

2) FMD1616-10 features 8 channel of 12-bit, 0-5V analog inputs and 2 channels of 12-bit analog outputs that can be configured by software to be 0-5V or 0-10V. Contrast this with T100MD1616+, which only has 4 channels of 10-bit analog inputs (2 ch x 0-1V, 2 ch x 0-5V) and 1 channel of 8-bit analog outputs (0-20mA) provided via two banks of screw terminals.

3) Since there is no current loop analog output on the FMD1616+ PLC, if this is required the user will need to source for an external 0-5V to 0-20mA converter. TRi may in the future provide such an interface via a converter board.

Please refer to Chapter 1 of the FMD1616-10 User's Manual for the wiring of the analog I/Os pins.

C. Non-volatile Variables and I/Os

Even with the installation of the FRAM-RTC- on the FMD1616-10, only the following variables can be configured to be non-volatile: A to Z, A$ to Z$ and DM[1] to DM[4000]. On the T100MD1616+ with MX-RTC, even some system variables such as RELAY[], EMINT[], EMLINT[] can be made non-volatile via DIP switch #1.

You can however overcome this by storing the system variable that needs to be made non-volatile into FRAM memory on the FRAM-RTC at every scan of the ladder logic program. A first-scan initialization function can then load the FRAM data back into the system variables. **Note**: the FRAM can be re-written unlimited number of times and read/write at full speed so it is a much better non-volatile memory than EEPROM.

Please refer to the next page for a comparison table that shows the main differences between the FMD1616-10 and the T100MD1616+. You will quickly discover that the FMD1616-10 + FRAM-RTC combination is more powerful and offers much better performance/cost ratio than a T100MD1616+ with 3 other optional peripherals (MX-RTC, M2018P and Xserver).

You will find that the FMD1616-10 delivers performance that is totally unmatched by any small PLCs on the market, and could easily be a game changer that you could use to upgrade the capability of your equipment beyond those of your competitors.

---- Please Turn to next page to view The Comparison Table ----

FMD1616-10 vs T100MD-1616+ Comparison Table

	FMD1616-10	T100MD-1616+
Ethernet	Built-in	-
Program Memory	8 K words	6 K words
CPU Speed	4 μs per step	10 μs per step
DM	1 to 1000	1 to 4000
Non-volatile EEP Memory	No real EEPROM. 1024 words emulated by RAM-shadowed Flash memory	1700 words
Analog Inputs		
- Resolution	12-bit	10-bit
- No. of Ch.	**8** x (0-5V)	**2** x (0-1V), **2** x (0-5V)
Connector type	**DB15**	Screw Terminal
Analog Outputs		
- Resolution	12-bit	8-bit
- No. of Ch.	**2** x (0-5V or 0-10V-software selectable)	**1** x (0-20mA)
Connector type	**DB15**	Screw Terminal
PWM Outputs		
- Resolution	0.01% (1 in 10000)	0.4% (1 in 250)
- No. of Ch.	4	2
- Frequencies	50 Hz to 50KHz	8 fixed frequecies
Serial Port		
RS232 Interface	True EIA-232	Transistor level-shifter
Compatible Baud Rates	110-1200,2400,4800,9600,19200,38400	110-1200,2400,4800,9600,19200,38400
Incompatible Baud Rates	57600,100K,115.2K,230.4K	62500,100K, 250K,500K

	FMD1616-10 + FRAM-RTC	T100MD-1616 + MX-RTC + M2018P + Xserver
Program Memory	16 K words	8.2 K words
RS232 port	Available	Used by Xserver exclusively
DM	1 to 4000	1 to 4000
Non-volatile Variables		
A to Z, A$ to Z$	Yes	Yes
DM[1] to DM[4000]	Yes	Yes
Sys Var. (e.g. INPUT[])	No	Yes
EMINT[], EMLINT[]	No	Yes
Non-volatile EEP memory	Ferromagnetic RAM	EEPROM
- No of Words	11,000	7,750
Write Speed	Very Fast	Slow
- Max Erase/Write	Unlimited	100,000 cycles
Real Time Clock		
Backup Battery	Replaceable	Non-replaceable