



MasterLogic-200

Specifications and Technical Data

Release R200

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Version 4.0

Release 200

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Revision History

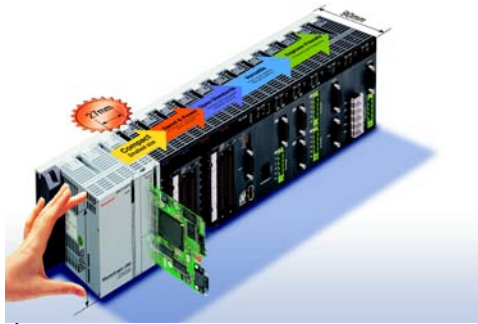
| Revision | Date | Changes |
|----------|----------------|--|
| 1.0 | September 2007 | Initial Version |
| 2.0 | January, 2008 | Included details on MasterLogic 200R |
| 3.0 | Sep, 2008 | Updated MasterLogic 200R Specifications |
| 4.0 | May, 2010 | Removed Experion PKS introduction, Included ML200R DC24V power supply , Removed Smart IO and Position Control Module |

Legend for Change Column:

- A – Added
- D – Deleted
- M – Modified

1. Introduction

1.1 Overview



MasterLogic-200, Honeywell's next generation Programmable Logic Controllers (PLC), adds power and robustness to logic-interlock-sequence batch control capabilities of Experion network.

It is state of the art, compact yet powerful & versatile, cost-effective solution ideal for fast logic, sequential, and batch control applications

The highlights of MasterLogic-200 PLC system are:

- Powerful & Versatile CPU (high speed / memory, IEC programming etc)
- Compact footprint (Rack room, cabinet space saver, shipping costs saver)
- Modular options (power supply, range of I/O modules to suit your configuration)
- Flexibility in module assignment – any module can be installed in any slot of any base without any restrictions.
- Open networks (Fast Ethernet, UTP/Fiber-Optic, serial RS232C /422/485)
- Open protocols (Profibus-DP, MODBUS ASCII/RTU/TCP)
- Peer-to-Peer networks (Dedicated Fast Ethernet on UTP/Fiber-optic)
- Simulation Environment to test control strategies without hardware or process connections.
- Engineer-friendly software (Connection options, easy configuration & trouble-shooting)
- Diagnostics (System/Error Logs, system monitoring, network monitoring, ping test, frame monitor)
- Experion PKS & Experion HS Integration (PLC alarm/events, clock synch, etc)

- Redundancy (CPU, Power, I/O network redundancy)

1.2 MasterLogic-200 PLC system architecture

Redundancy options

MasterLogic-200 provides the control system designer with various redundancy architecture options that fits the requirement.

Fully Redundant system

CPU Model: 2MLR-CPUH/# provides a fully redundant system:

- Redundant CPU
- Redundant Power
- Redundant I/O cable (ring topology with dual paths)

Non-redundant system

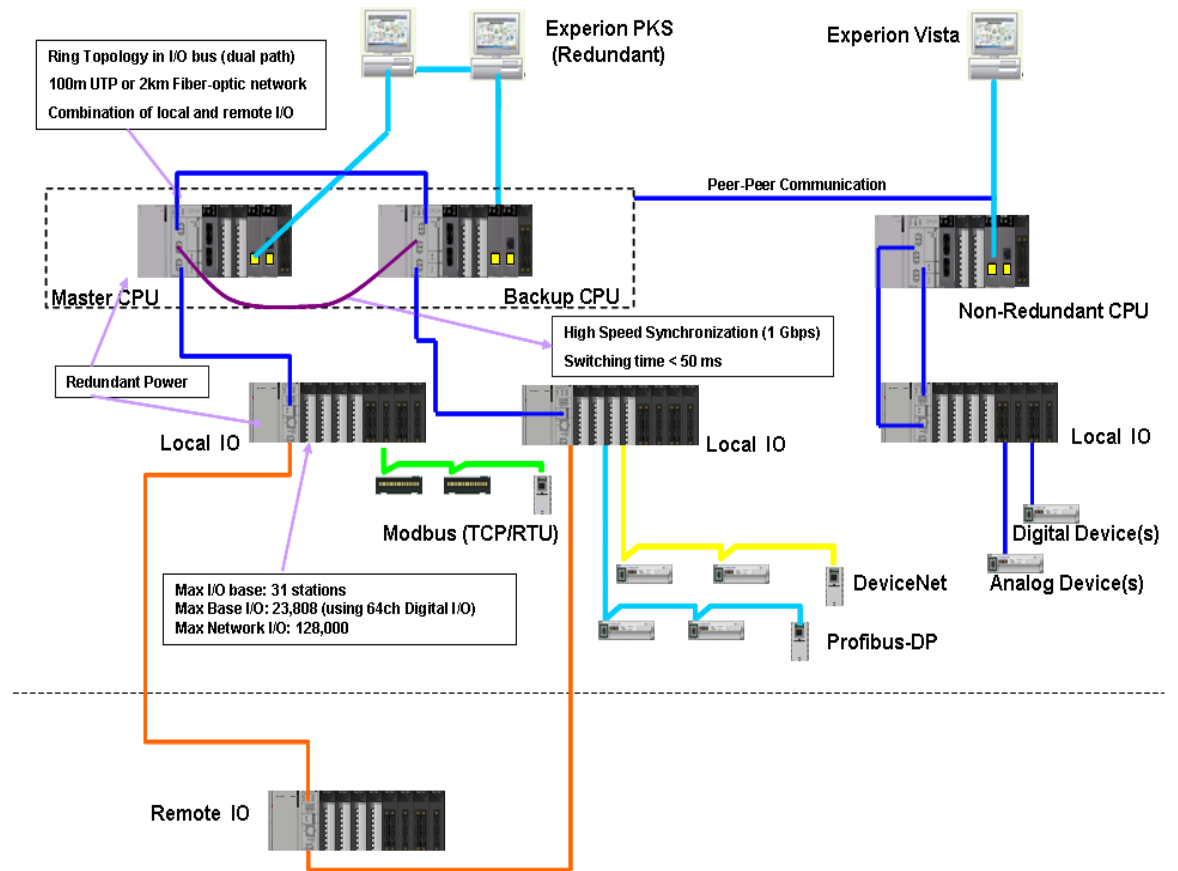
For cost-effective applications, CPU Model: 2MLI-CPUU provides a fully non-redundant system:

- Non-redundant CPU
- Non-redundant Power
- Non-redundant I/O cable

Non-redundant CPU but Redundant Power and I/O cable



A slight variation of the fully redundant architecture with only the master CPU of 2MLR-CPUH/# (excluding the standby CPU) offers the functionality of:

- Non-Redundant CPU
- Redundant Power
- Redundant I/O cable (ring topology with dual paths)



1.3 General Specifications

| No. | Item | Specifications | Related Standards | | | |
|-----|------------------|---|----------------------------------|----------------------------|------------|--------------------------------------|
| 1 | Ambient Temp. | 0 ~ 55°C | | | | |
| 2 | Storage Temp. | -25 ~ +70°C | | | | |
| 3 | Ambient humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 4 | Storage humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 5 | Vibration | Occasional vibration | | - | IEC61131-2 | |
| | | Frequency | Acceleration | Pulse width | | Sweep Count |
| | | $10 \leq f < 57\text{Hz}$ | - | 0.075mm | | 10 times each direction (X, Y and Z) |
| | | $57 \leq f \leq 150\text{Hz}$ | 9.8m/s ² (1G) | - | | |
| | | Continuous vibration | | | | |
| | | Frequency | Acceleration | Pulse width | | |
| | | $10 \leq f < 57\text{Hz}$ | - | 0.035mm | | |
| | | $57 \leq f \leq 150\text{Hz}$ | 4.9m/s ² (0.5G) | - | | |
| 6 | Shocks | <ul style="list-style-type: none"> Peak acceleration: 147m/s²(15G) Duration: 11ms Pulse wave type: Half-sine (3 times in each of X, Y and X directions) | IEC61131-2 | | | |
| 7 | Noise immunity | Square wave impulse noise | ±1,500V | | | |
| | | Electrostatic discharge | Voltage: 4kV (Contact discharge) | IEC61131-2 IEC61000-4-2 | | |

| | | | | | | |
|----|-----------------------|---|--|--------------|--|-----------------------------|
| | | Radiated electromagnetic field noise | 27 ~ 500MHz, 10V/m | | | IEC61131-2, IEC61000-4-3 |
| | | Fast transient /Burst noise | Classification | Power supply | Digital/Analog Input/Output, Communication Interface | IEC61131-2 IEC61000-4-4 |
| | | | Voltage | 2kV | 1kV | |
| 8 | Atmosphere | Free from corrosive gases and excessive dust | | | | |
| 9 | Altitude | Less than 2,000m | | | | |
| 10 | Pollution degree | Less than 2 | | | | |
| 11 | Cooling method | Air-cooling | | | | |
| 12 | Agency Certifications |  | UL 508 Industrial Control Equipment | | | |
| | |  | 89/336/EEC, EMC Directive EN 50081-2, Emissions, Industrial EN 50082-2, Immunity, Industrial | | | |

Note:

IEC (International Electrotechnical Commission) – An international civil community that promotes international cooperation for standardization of electric/ electro technology, publishes international standard and operates suitability assessment system related to the above.

Pollution Degree – An index to indicate the pollution degree of used environment that determines the isolation performance of the device. For example, pollution degree 2 means the state to occur the pollution of non-electric conductivity generally, but the state to occur temporary electric conduction according to the formation of dew.

Compliance to European Union Directives. This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives:

EMC Directive. This apparatus is tested to meet Council Directive 89/ 336/ EEC Electromagnetic Compatibility (EMC) using a technical construction file and the following standards, in whole or in part:

- EN 50081- 2 EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082- 2 EMC – Generic Immunity Standard, Part 2 – Industrial Environment

The product described in this document is intended for use in an industrial environment.

Low Voltage Directive. This product is also designed to meet Council Directive 73/ 23/ EEC Low Voltage, by applying the safety requirements of EN 61131– 2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

1.4 CPU Summary Specifications

| No. | Item | Specifications | | Related Standards | |
|-----|--------------------------------------|--|--|--|--|
| | | 2MLI-CPUU Non-redundant | 2MLR-CPUH/# Redundant or Non-redundant | | |
| 1 | Program Execution methods | Cyclic scan, Time-driven interrupts, Internal Memory interrupts | | | |
| 2 | I/O control method | Scan synchronous batch processing I/O (refresh method), Direct I/O method by program instruction | | | |
| 3 | Program language | Ladder Diagram, Sequential Function Chart, Structured Text, Instruction List (view only) | | | |
| 4 | Number of instructions | Operator | 18 | | |
| | | Basic functions | 136 + real number operation function | 130 + real number operation function | |
| | | Basic function block | 43 | 41 | |
| | | Dedicated function block | Special function blocks, Process function blocks Dedicated communication function blocks (P2P) | | |
| 5 | Processing speed (Basic instruction) | LD | 0.028 μ s/Step | 0.042 μ s/Step | |
| | | MOV | 0.084 μ s/Step | 0.112 μ s/Step | |
| | | Real number operation | \pm : 0.392 μ s (S), 0.924 μ s (D) \div : 0.924 μ s (S), 2.254 μ s (D) x: 0.896 μ s (S), 2.240 μ s (D) | \pm : 0.602 μ s (S), 1.078 μ s (D) \div : 1.106 μ s (S), 2.394 μ s (D) x: 1.134 μ s (S), 2.660 μ s (D) | S: Single real number D: Double real number |
| 6 | Program memory | 7 MB | | | |
| 7 | Max # I/O bases | 8 (main + 7 extension) | 31 | | |
| 8 | Max # slots | 96 | 372 | | |
| 9 | Max base I/O | Using 64 ch DI/DO module | 6,144 (64ch * 96 slots) | 23,808 (64ch*372 slots) | |
| | | Using 32 ch DI/DO module | 3,072 (32ch * 96 slots) | 11,904 (32ch*372 slots) | |
| 10 | Max I/O extension distance | 15m (proprietary cable) | 100m (UTP cable) 2km (Fiber-optic cable) | +open standards | |

| | | | | | |
|----|--------------------------|----------------------------|--|---------------------------------|--|
| 11 | Max Network / Remote I/O | 128,000 | 128,000 | Using network I/O | |
| 12 | Flash Memory | 16 MB | | | |
| 13 | Data Memory Capacity | Symbolic Variable Area (A) | 512 KB (Maximum, 256 KB retain settable) | | |
| | | Timer | No point limit Time Range: 0.001 ~ 4,294,967.295 seconds (1,193hours) | | Occupying 20 bytes of symbolic variable area per point |
| | | Counter | No point limit Coefficient Range : -32,768 ~ +32,767 | | Occupying 8 bytes of symbolic variable area per point |
| | | Direct Variable | M | 512 KB | Fixed Area Variable |
| | | | R | 64 KB * 2 (%RW0~%RW32767) | File Register (uses flash memory) |
| | | | I | 16 KB (%IW0.0.0~%IW127.15.3) | Input Image Area |
| | | | Q | 16 KB (%QW0.0.0~%QW127.15.3) | Output Image Area |
| | | | W | 128 KB (%WW0~%WW65535) | File Register (uses flash memory) |
| | | Flag Variables | F | 4 KB | System Flag |
| | | | K | 18 KB (PID 256 loops) | PID Flag |
| | | | L | 22 KB | High Speed Link Flag |
| | | | N | 42 KB | P2P Flag |
| U | 32 KB | | Analog Refresh Flag as VAR_GLOBAL | | |

| | | | | | |
|----|----------------------------------|--|--|---|--|
| 14 | Program Type Allocation | INIT task | 1max | | |
| | | Timer Interrupt tasks | 32 max | | |
| | | Internal Device Interrupt tasks | 32 max | | |
| | | Scan program | Balance: 256 minus sum of above | | |
| | | Total | 256 max | | |
| 15 | CPU operation mode | RUN, STOP, DEBUG | | | |
| 16 | CPU restart mode | Cold or warm restart | | | |
| 17 | Self-diagnosis | Watchdog timer, memory error, I/O error, battery error, power error, communication error etc. | | | |
| 18 | Built-in Program port | RS-232C(1CH) | | Modbus slave supported via RS-232C port | |
| | | USB (1CH) @ 12MBPS | | | |
| | | Note: Additional program connections via Ethernet & serial communication module (locate or remote) | | | |
| 19 | Data storage method at power off | Retain area configuration via Basic parameters | | | |
| 20 | Current consumption (mA) | 960 | 1173 (2MLR-CPUH/T) 1360 (2MLR-CPUH/F) | | |
| 21 | Weight (kg) | 0.12 | 0.257 (2MLR-CPUH/T) 0.276 (2MLR-CPUH/F) | | |
| 22 | Redundancy Feature | | | | |
| | Watchdog between CPUs | NA | Sync cable and Ring-type I/O Network | | |
| | Data Backup | NA | 1Gbps Fiber Optic, max. 200m | | |
| | Synchronization Method | NA | Configured in Redundancy parameter | | |
| | Sync Cable Specification | NA | 62.5/125 Multi-mode Fiber LC type connector (Lucent Connector) Return Loss : over 45db | | |
| | Delay time for redundant | NA | Varies with data size | | |

| | | | | |
|--|-----------------------------------|----|---|--|
| | operation | | between CPUs - Default: 8.2ms / max. 80ms | |
| | Switchover Time | NA | 22ms | |
| | Operation delay during switchover | NA | Max. time of delay time for redundant operation | |

1.5 Powerful & Versatile CPU

High Speed

Facilitated by a powerful state of the art processor (NGP1000), MasterLogic-200 CPU provides high speed execution of program instructions and backplane/communication data transfers. In addition, dedicated intelligent communication modules (Ethernet, Serial, Profibus etc) offer co-processing assistance to the main controller CPU.

High Memory

High memory of MasterLogic-200 CPU combined with high speed & huge I/O capacity feature provides a robust platform for efficient performance in large applications.

Summary specification for CPU Models: 2MLI-CPUU & 2MLR-CPUH/#

| Memory Specification | Memory size | Remarks |
|--------------------------------------|-------------|--|
| Total Memory | 25 MB | |
| Built-in Flash Memory | 16 MB | For program & data backup |
| Program Memory (Incl. System Memory) | 7 MB | For program execution, upload, system parameters, history logs |
| Data Memory | 2 MB | Direct variables & Symbolic (named) variables |

Free slot assignment

This is good news to engineers handling base/slot assignment. MasterLogic-200 poses no restriction whatsoever. Any module type i.e. digital I/O, analog I/O, HSC (pulse input), RTD, Thermocouple, and even communication modules (i.e. Ethernet, Serial, Profibus-DP, DeviceNet) can be freely assigned to any base/slot irrespective of base #, Slot #.

Without any restriction, any of the above modules (except for Ethernet module) can also be installed in remote I/O bases located far away (by using FO network of 2MLR-CPUH/#).

Large I/O capacity

MasterLogic-200 accommodates a huge I/O capacity through base I/O and remote/network I/O capabilities. The I/O capacity details are tabulated as follows:

Model: 2MLI-CPUU (Non-redundant)

| Model: 2MLI-CPUU | Qty | Remarks | |
|---------------------------------------|----------------|---------------------------------|---------------------------------|
| Max # of bases | 8 | 1 main base + 7 extension bases | |
| Max # of slots | 96 | 12 slots * 8 base = 96 slots | |
| Base I/O | 6,144 points | Using 64 ch DI/DO module | 96 slots * 64 ch = 6,144 points |
| | 3,072 points | Using 32 ch DI/DO module | 96 slots * 32 ch = 3,072 points |
| Network & Remote I/O (Max I/O memory) | 128,000 points | Using network I/O | |

Model: 2MLR-CPUH/# (Non-redundant or Redundant)

| Model: 2MLR-CPUH/# | Qty | Remarks | |
|------------------------------|----------------|--|-----------------------------------|
| Max # of I/O bases | 31 | On either Ethernet or Fiber-optic networks | |
| Max # of slots | 372 | 12 slots * 31 base = 372 slots | |
| Base I/O | 23,808 points | Using 64 ch DI/DO module | 372 slots * 64 ch = 23,808 points |
| | 11,904 points | Using 32 ch DI/DO module | 372 slots * 32 ch = 11,904 points |
| Network I/O (Max I/O memory) | 128,000 points | Using network I/O modules. | |

High Speed Synchronization

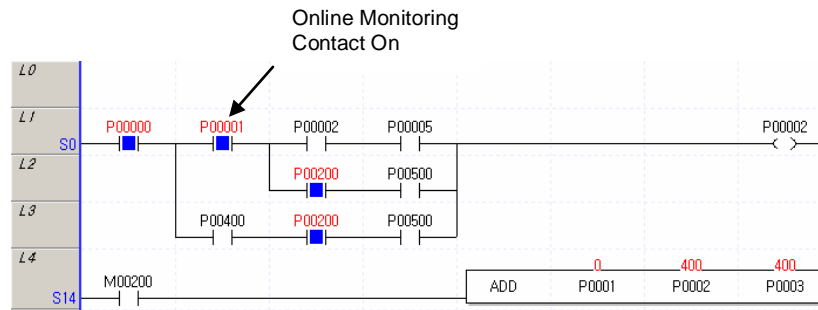
In redundant CPU systems, a dedicated high speed 1Gigabit fiber-optic link between primary and backup CPU ensures efficient synchronization of data and program memory areas. Upon failure of the primary CPU, the control switches over to the backup CPU bumplessly in less than 50 msec.

IEC 61131-3 Standard Programming Languages

MasterLogic-200 PLCs do not restrict the control engineers with a solitary ladder programming (LD) language. Their work is made easier with a choice of IEC standard programming languages. Each of the IEC 61131-3 standard programming language is designed for a specific application.

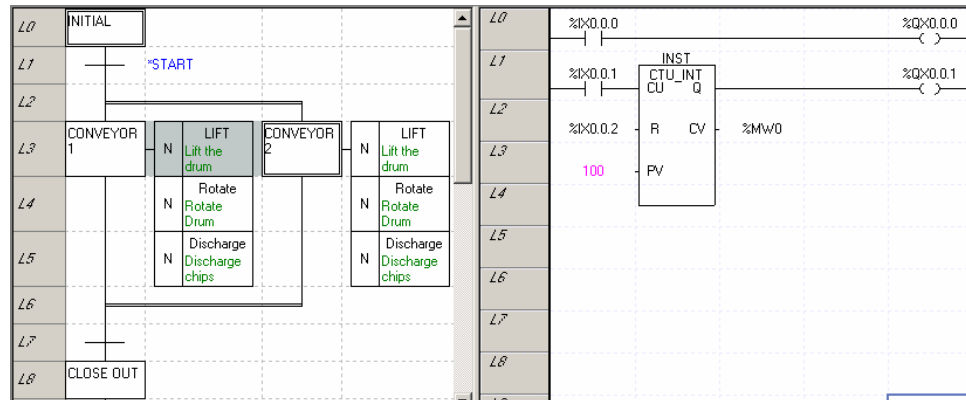
Ladder (LD)

MasterLogic-200 provides a friendly ladder (LD) programming editor, best suited for relay logic / interlocks with timers and counters. The same editor serves as online monitoring display for trouble-shooting situations.



Sequential Function Chart (SFC)

However, ladder would be cumbersome for the engineer to build strategies for sequencing/batching applications with state/transition conditions. Sequential Function Chart (SFC) visual programming editor best suited for that purpose is provided.



Structured Text (ST)

Likewise, so as to build a own library of user-defined function blocks or being accustomed to computer languages like BASIC, PASCAL etc, the engineer would be inclined to pick Structured Text (ST) language as the right choice.

```

1 @D+
2
3 //FIND MAXIMUM VALUE
4 MAX_VALUE := 16#FFFFFF;
5
6 // INITIALIZE BUFFER
7
8 IF ON THEN
9   FOR IDX := 0 TO 31 DO;
10    NEW_IDX := DINT_TO_INT(RAND(TOD_TO_DWORD( RTC_TOD)) MOD 32);
11    ARRAY_VALUE[NEW_IDX] := TOD_TO_DWORD( RTC_TOD);
12  END_FOR;
13 END_IF;
14
15 ADD
16
17
18
19
20
21
22
23
24
25
26
27 FOR IDX := 1 TO 31 DO
28   JDX := IDX + 1;

```


Instruction List (IL – View only mode)

A mnemonic assembly-type programming language (currently in view only mode) to assist to cross-verification of ladder program sequences.

| | | | |
|---|------|--|----------|
| 1 | LOAD | | %IX0.0.0 |
| 2 | OUT | | %QX0.1.0 |
| 3 | LOAD | | %IX0.0.1 |
| 4 | OUT | | %QX0.1.1 |
| 5 | LOAD | | %IX0.0.2 |
| 6 | OUT | | %QX0.1.2 |

Flexibility to mix & match

MasterLogic-200 empowers the control engineer with flexibility to mix & match different languages in a single CPU with modular programs, each serving a specific requirement typical to industrial process control situations.

| Programming Language | Remarks |
|---------------------------------|---|
| LD (Ladder) | Relay logic / interlocks |
| SFC (Sequential Function Chart) | State / Transition diagrams for sequential/batch applications |
| ST (Structured Text) | BASIC, PASCAL like programming language |
| FB (Function Block) | To be used / embedded in other programming languages e.g. LD, SFC, ST |
| IL (Instruction List) | View only mode of LD instructions |

Program Types & Modular Programs

MasterLogic-200 allows modularizing the whole control strategy for the PLC into max. 256 easily manageable sub-programs, executed either cyclically once every scan in the order or interrupt driven based on timer or memory conditions.

| Program Type | Max # | Task # | When executed? |
|-------------------|------------|--------|--|
| INIT Program | 1 | | Executed once during PLC startup |
| Timer Interrupts | 32 | 0~31 | Executed when timer interval elapses (configurable @ 1msec resolution) |
| Device Interrupts | 32 | 64~95 | Executed when configured internal memory condition occurs |
| Scan Programs | Balance | | Executed once every scan |
| Total | 256 | | |

Note: Task ID 32~63 reserved for future use (I/O interrupt conditions)

Cold or Warm Restart Options

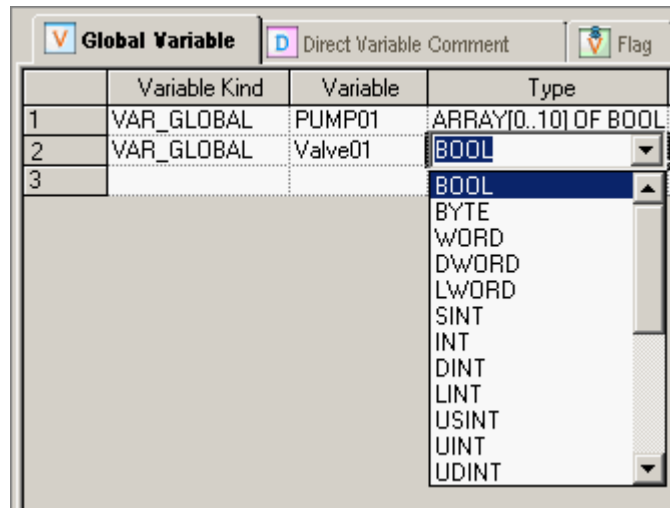
MasterLogic-200 provides two CPU restart modes, cold or warm options to fit the restart circumstances.

| Mode Parameter | Cold Restart | Warm Restart |
|---------------------------|--------------------------------------|--------------------------------------|
| Default | Initializing as '0' | Initializing as '0' |
| Retain | Initializing as '0' | Maintaining the previous value |
| Initialization | Initializing as a user-defined value | Initializing as a user-defined value |
| Retain and initialization | Initializing as a user-defined value | Maintaining the previous value |

IEC data types

The following are IEC standard data types supported by MasterLogic-200 programs in accessing direct & symbolic (named) variables. Variables can be defined as local (accessible only within the program) or global variables (accessible across all programs).

| Data Category | Data types supported |
|--------------------------|--|
| Bit | BOOL |
| Byte | BYTE |
| Word | WORD, DWORD, LWORD |
| Integer | SINT, INT, DINT, LINT |
| Unsigned Integer | USINT, UINT, UDINT, ULINT |
| Real | REAL (Single precision), LREAL (Double precision) |
| Date & Time | TIME, DATE, TIME_OF_DAY, DATE_AND_TIME |
| Text Character | STRING |
| Array | ARRAY (3-dimensional arrays, max array size of 32767 elements) |
| User-defined data type | STRUCT |
| Function Block instances | FB_INST |



Three-dimensional arrays

Array variables are extremely useful to a programmer to store a series of related data items. For example, an array variable Tank_Level[0..9] can be used to store level values of a max of 10 similar tanks typically using “for loop” command.

| | Variable Kind | Variable | Type | AT | Initial Value | Retain | Used | Comment |
|---|---------------|-------------|----------------------------------|----|---------------|--------------------------|--------------------------|--------------------------|
| 1 | VAR | AVE_HOURLY | ARRAY[0..23] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Single Dimensional Array |
| 2 | VAR | AVE_DAILY | ARRAY[0..23,0..30] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Two Dimensional Array |
| 3 | VAR | AVE_MONTHLY | ARRAY[0..23,0..30,0..11] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Three Dimensional Array |
| 4 | | | | | | <input type="checkbox"/> | <input type="checkbox"/> | |

Function Block & Instruction Library

Drastically reducing engineering time, a vast library of instructions & function blocks is pre-built and packaged with MasterLogic-200 system. Here is an overview of the function block library available for the control engineer.

| Function Type | Functions / Function Blocks |
|-----------------------------|--------------------------------------|
| Input Contacts ⁺ | NC/NO Contact , ±Transition contacts |

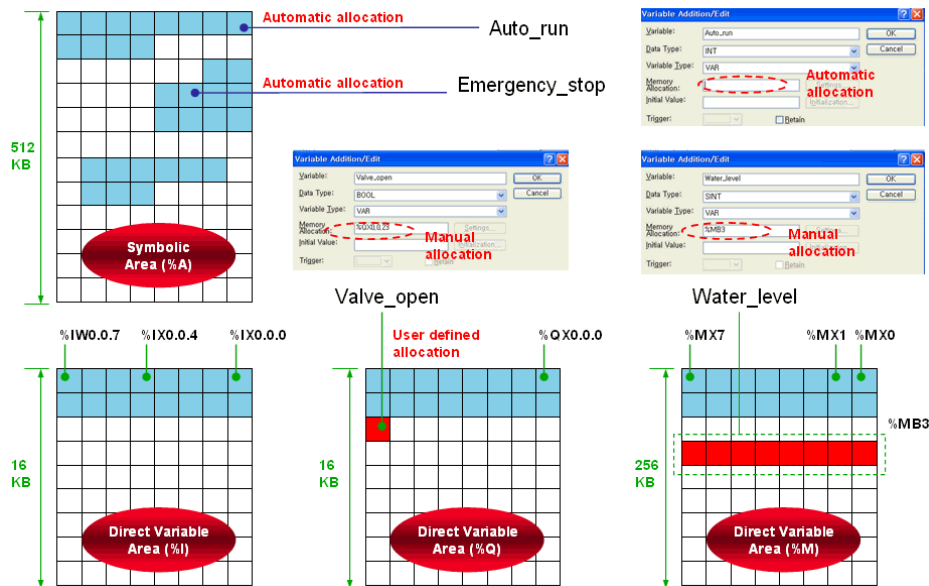
| | |
|--------------------------|---|
| Coils [†] | Coil/Negated coils, Set/Reset coils (latch), \pm Transition sensing coils |
| Data type conversions | Bool_to_*, Byte_to_*, Word_to_*, Int*_to_*, UInt*_to_*, Real*_to_*, Time_to_*, Date_to_*, String_to_*, BCD_to_*, *_to_BCD |
| Bit functions | AND, OR, NOT, XOR, XNR, SHL, SHR, ROL, ROR etc. |
| ARRAY functions | Move, Rotate, Compare, Fill, Average, Shift etc. |
| Comparison Functions | GT, EQ, GE, LT, LE, NE |
| Timer | On Delay, Off Delay, Pulse Timers... |
| Counter | Count up, Count Down, Count Up/Down... |
| String Functions | CONCAT, LEFT, RIGHT, MID, INSERT, DELETE, REPLACE... |
| Process Control | Average, Delay, Limit, Rate, Summer, Totalizer, Analog_Selector, Function Generator, Lead Lag PID with auto tuning, Cascade control , Ratio Control, Alarm, Ramp |
| Stack Functions | LIFO_***, FIFO_***... |
| Date & Time functions | Multiply, Subtract, Divide, Add functions on date and time variables |
| Mathematical functions | Exponential, Degree/Radian, ADD/MUL/DIV/SUB, ABS, MOD, Trigonometric (SIN, COS, TAN...), SQRT, LOG... |
| Select Functions | Max, Min, Multiplex... |
| System Control Functions | SCON, DUTY, STOP, ESTOP, DIREC_IN/O, Watchdog reset, Master Clear, Semaphore etc. |

[†] Basic instructions in ladder program

Symbolic (Named) Variables with auto memory allocation

A significant amount of data memory, as high as 512KB, is allocated for Symbolic variables in MasterLogic-200 CPU. This is equivalent to 50% of the total data memory, thus intensifying the utilization of auto memory allocation.

The control engineers can simply building named variables circumventing the hassles of manual memory allocation and derive the convenience of letting the CPU automatically allocate memory according to the data types. This eliminates human lapses involved in duplicate assignment, unused memory etc.

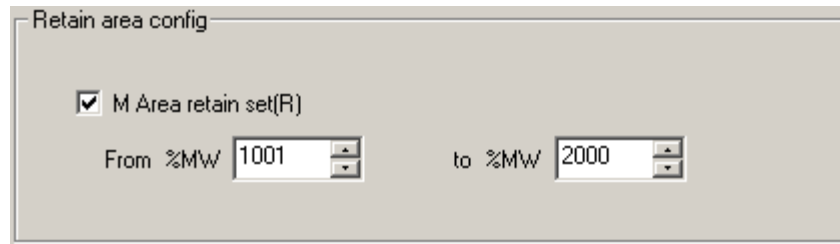


Retention Memory

Portions of data memory area provide (non-volatile) memory retention function.

- %R (File Register) memory area comprising 2 blocks of 64KB each serving always as non-volatile memory for the engineers. Data stored here will be retained even upon power failure to CPU and during cold or warm restart options. The data in this area can be cleared only by operating the CPU switch D.CLR for > 3 sec or upon battery failure

- Also the control engineer can selectively configure portion of %M memory areas for memory retention in “Basic Parameters”. A max of 128KB can be configured for memory retention in %M area.



- In addition to the above two, symbolic variables (named variables) occupying 512KB of data memory (local and global) can be individually configured for memory retention during variable declaration phase.

| | Variable Kind | Variable | Type | AT | Initial Value | Retain | Used | Comment |
|---|---------------|-------------|----------------------------------|----|---------------|--------------------------|--------------------------|--------------------------|
| 1 | VAR | AVE_HOURLY | ARRAY[0..23] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Single Dimensional Array |
| 2 | VAR | AVE_DAILY | ARRAY[0..23,0..30] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Two Dimensional Array |
| 3 | VAR | AVE_MONTHLY | ARRAY[0..23,0..30,0..11] OF WORD | | | <input type="checkbox"/> | <input type="checkbox"/> | Three Dimensional Array |
| 4 | | | | | | <input type="checkbox"/> | <input type="checkbox"/> | |

Refer to the following table for the maintenance or reset (clear) of the retain area data according to the PLC operation.

| Item | Symbolic Variables | M area retain | R area |
|----------------|---|--------------------------------|--------------------------------|
| Reset | Maintaining the previous value | Maintaining the previous value | Maintaining the previous value |
| Over all reset | Initializing as '0' | Initializing as '0' | Maintaining the previous value |
| DCLR | Initializing as '0' | Initializing as '0' | Maintaining the previous value |
| DCLR (3sec) | Initializing as '0' | Initializing as '0' | Initializing as '0' |
| STOP→RUN* | Warm: Maintaining the previous value | Maintaining the previous value | Maintaining the previous value |

| | | | |
|--|------------------------------|--|--|
| | Cold: Initializing as '0' | | |
|--|------------------------------|--|--|

* Cold Restart Mode if the program is downloaded

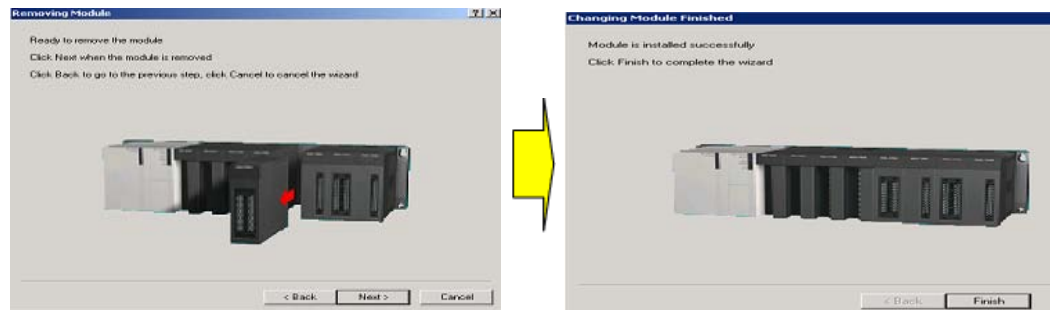
Please refer to [Cold or Warm Restart Options](#) section to know more about memory retention functions.

Online Maintenance Functions

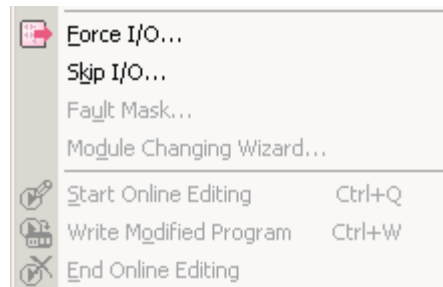
Hot-swapping

Any faulty I/O module can be swapped online with a new one without having to stop a running CPU. There are two methods:

- o By operating a switch M.XCHG in CPU module (Available for 2MLI-CPUU only)
- o By running a software wizard in SoftMaster



Online Editing



Any part of the PLC program can be edited online when CPU is running & the new program can be downloaded to the CPU without having to stop the CPU.

SoftMaster allows an intermediate step of downloading the modified program to CPU and monitor the outcome. The programmer can continue to make changes if required without quitting the

session.

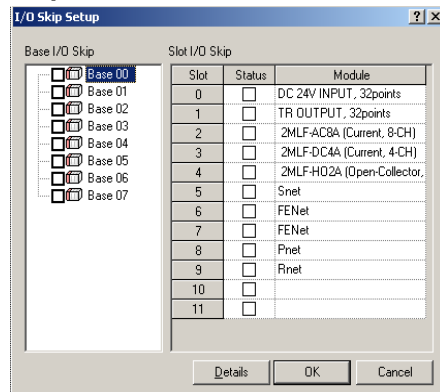
Fault Mask

Fault Mask enables program to continue uninterrupted even if a module error occurs. Fault Mask can be set for any base/slot module either by

- SoftMaster software tool
- Program instruction setting fault mask flag

Only the faulty module stops operating while the overall system continues to operate due to Fault Mask settings. If there is no error in the module, CPU works normally with this setting.

Skip I/O



Skip I/O setting for any base/slot module instructs the CPU to skip processing of specified I/O module(s). The input image (%) area would not be refreshed for those modules and output image area will not be transferred to the actual module.

Force I/O

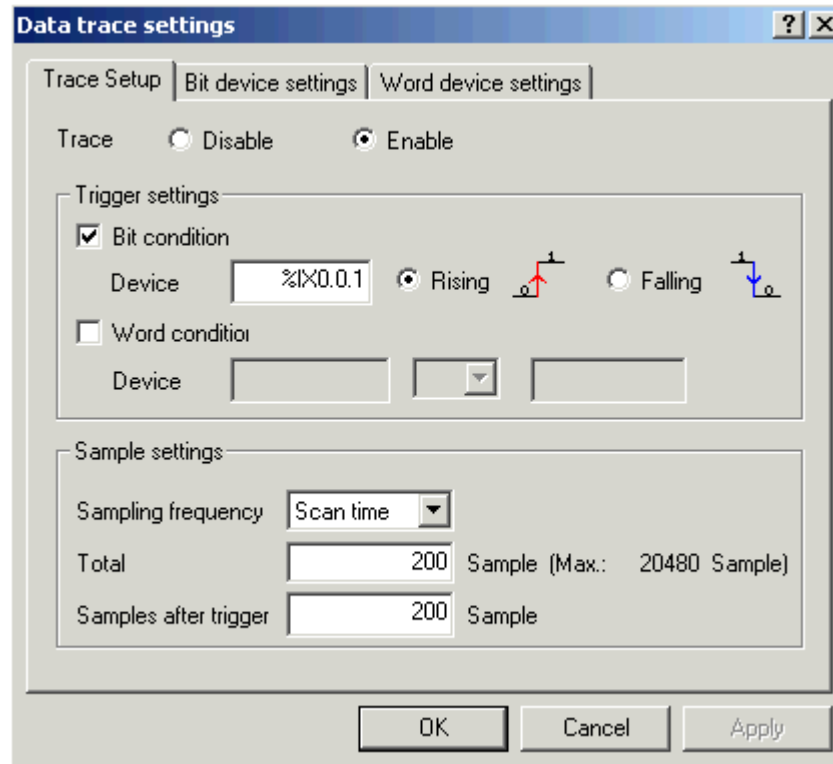


This function enables the control engineer to force either ON or OFF values to digital input or output locations in I/O bit image areas.

Data Trouble-shooting Functions

Data Tracing

This is one of unique features of MasterLogic PLC. Data tracing works at CPU level, quite different from the trend monitoring feature usually available at software level in many PLCs. Configure the trace parameters (trigger condition, trace variables, sampling size) and trouble-shoot the variables in trend graphic or tabular format.

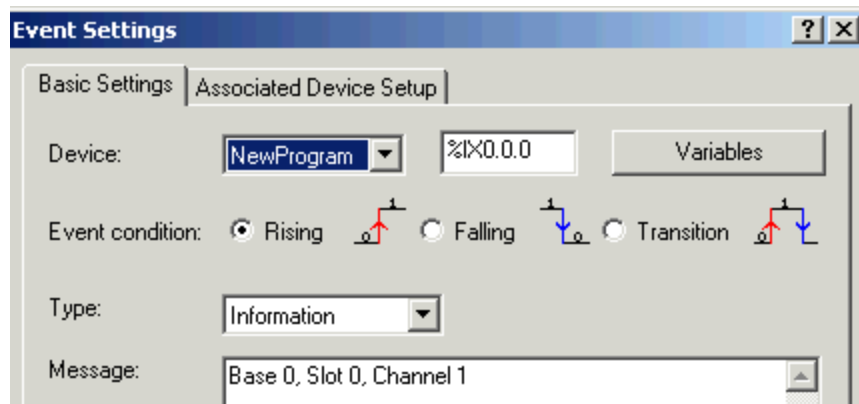


| Function | Specification |
|------------------------------|--|
| Data Trace Trigger Condition | Bit variable: Rising, Falling Word variable: <, <=, >, >=, == Also can be manually triggered from SoftMaster |
| Sampling Frequency options | Scan time, 20ms, 50ms, 100ms, 200ms, 500ms, 1000ms, 2000ms |
| Total # of samples | Calculated based on trace variable data types |
| Samples after trigger | Decides whether and how much of samples are needed before or after the trigger |
| Trace variables | Bit variables: 16 variables max Word variables: 8 variables max |
| Storage | Trace data will be stored and protected in CPU memory until the trigger condition reoccurs or a new setting is downloaded. |
| Trace Data Presentation | Optionally in user-friendly graphical tool or tabular data format in MS-Excel |



User-defined Custom Events

Configure user-defined custom event settings and download to CPU for logging events in database. Trigger conditions can be any bit variable, direct or symbolic. Also 16 variables (bit, word, real data type) can be associated to the event whose current value will be captured when the event is triggered.



| ID | Program | Variable | Device | Type |
|----|------------|----------|----------|------|
| 1 | NewProgram | | %MWO | INT |
| 2 | NewProgram | | %QX0.0.0 | BOOL |
| 3 | NewProgram | | %MW2 | INT |

| Custom Event | | | | | |
|----------------|-------------|---------------|------------|--------------|--------|
| Event Settings | | Event History | | | |
| Number | Type | Event ID | Date | Time | Device |
| 1 | Information | 3 | 2005-07-22 | 11:54:17:267 | F00094 |
| 2 | Information | 1 | 2005-07-22 | 11:54:18:272 | F00095 |
| 3 | Information | 3 | 2005-07-22 | 11:54:19:272 | F00094 |

| Function | Specification |
|--|---|
| Max # of variables that can be configured for custom event trigger | 10 variables |
| Associated variables | Max 16 variables (bit, word, real data type) can be associated to the event for current value capture |
| Max buffer size for custom event capture in CPU | 300 events |
| Variable type for event trigger | Only bit variables |
| Trigger condition | Rising, Falling, Transition options |
| Trigger Detection Speed | Scan time (milli-sec time stamping) |
| Event category | Information, Critical, Alarm |
| Applications | Trouble-shooting, Limited SOE |

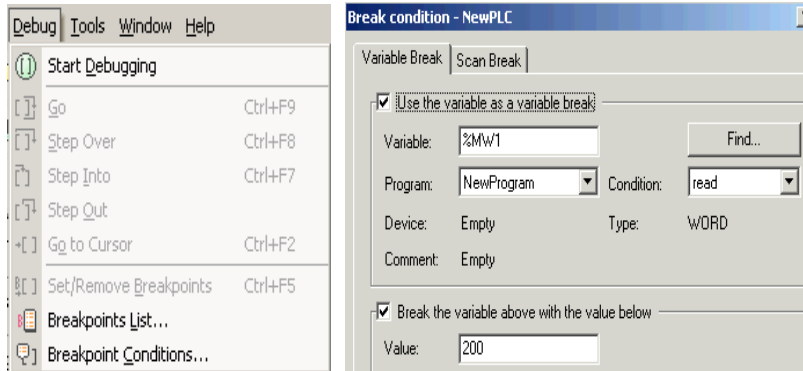
RTC (Real-time Clock)

MasterLogic-200 has a built-in clock (RTC) which runs on battery even in case of power failure. The RTC can be monitored & updated, if necessary, through:

- SoftMaster (manual command from GUI)
- Experion PKS server (auto sync with server clock)
- Programming instructions

All system events, custom events & errors logs are time stamped using RTC.

Debug Modes



MasterLogic-200 program can be optionally started in DEBUG mode for any specific trouble-shooting. Breakpoints can be either:

- Manually set on / removed from any line of the program regardless of the programming language used.
- Set for trigger by internal memory variable or scan cycle count conditions

PLC History - System alarm & events

MasterLogic-200 CPU records four different types of system alarms & events occurring in PLC.

| PLC history - NewPLC | | | |
|---|------------|--------------|---------------------|
| Error Log Mode Log Shut down Log System Log | | | |
| Index | Date | Time | Contents |
| 84 | 2005-08-18 | 18:41:33.001 | Data trace, Use |
| 85 | 2005-08-18 | 18:43:32.865 | Momently shut-down |
| 86 | 2005-08-18 | 18:46:09.001 | Data trace, Use |
| 87 | 2005-08-18 | 18:57:16.181 | USB, OK, Connect |
| 88 | 2005-08-18 | 18:57:19.876 | USB, OK, Disconnect |
| 89 | 2005-08-18 | 18:57:23.541 | USB, OK, Connect |

| Event type | Description | Buffer Size in CPU |
|------------|--|--------------------|
| Error Log | Any error occurring in system – error code, timestamp, error details | 2048 events |

| | | |
|--------------------|---|-------------|
| System Log | Operation history of key system events with timestamp | 2048 events |
| Mode change Log | CPU mode changes, RUN/STOP/DEBUG with timestamp | 1024 events |
| Power shutdown Log | Power ON/OFF, failure events with timestamp | 1024 events |

The event buffer in CPU is limited and FIFO cyclic. But all the above 4 types of PLC alarms & events can be archived in Experion and consolidated with Experion system alarms & events display. Please refer to MasterLogic-Experion Integration specification for further details.

1.6 Power Supply Modules (2MLI-CPUU)

There are four power supply modules with different specifications to choose from, according to the site requirements e.g. flexible voltage input range, DC input power, output voltages and current rating. The below specifications are applicable for CPU model: 2MLI-CPUU

| Item | | 2MLP-ACF1 | 2MLP-ACF2 | 2MLP-AC23 | 2MLP-DC42 |
|--------------|------------------------------------|---|--------------|-------------------|-----------------------------|
| Input | Rated input voltage | AC 100V – AC 240V | | AC 200V – AC 240V | DC 24V |
| | Input voltage range | AC 85V ~ AC 264V | | AC 170V ~ AC 264V | - |
| | Input frequency | 50 / 60 Hz (47 ~ 63 Hz) | | | - |
| | Inrush current | 20 A _{Peak} or less | | | 80A _{Peak} or less |
| | Efficiency | 65% or more | | | 60% or more |
| | Input fuse | Built-in (user no change), UL standard (Slow Blow Type) | | | |
| | Allowed instantaneous interruption | 10 ms and shorter | | | |
| Output1 | Output voltage | DC 5V ($\pm 2\%$) | | | DC5V ($\pm 2\%$) |
| | Output current | 3.0A | 6.0A | 8.5A | 6.0A |
| | Over current protect | 3.2A or more | 6.6A or more | 9.0A or more | 6.6A or more |
| | Over voltage protect | 5.5V ~ 6.5V | | | |
| Output2 | Output voltage | DC 24V ($\pm 10\%$) | - | - | - |
| | Output current | 0.6A | | | |
| | Over current protect | 0.7A or more | | | |
| | Over voltage protect | None | | | |
| Relay Output | Application | RUN contact | | | |
| | Rated switching voltage/current | DC 24V, 0.5A | | | |
| | Minimum switching load | DC 5V, 1 mA | | | |

| | | | | |
|---------------------|---------------|---|-------|-------|
| | Response time | OFF→ON/ ON→OFF: 10 ms or less/12 ms or less | | |
| | Life | Mechanical life: 20 million and more times Electrical life: rated switching current: 100 thousand and more times | | |
| Voltage indicator | | Output voltage normal, LED ON | | |
| Cable specification | | 0.75 ~ 2mm ² | | |
| Compressed terminal | | RAV 1.25 - 3.5, RAV 2 - 3.5 | | |
| Weight | | 0.4kg | 0.6kg | 0.5kg |

Battery Specifications

| Item | Specifications |
|-------------------------|---|
| Nominal voltage/current | DC 3.0V / 1,800mAh |
| Warranty period | 5 years (at ambient temperature) |
| Purpose | Program and data backup, RTC operation when Power-OFF |
| Specification | Manganese dioxide lithium battery |
| Outer dimension (mm) | φ 17.0 X 33.5mm |

1.7 Power Supply Modules (2MLR-CPUH/#)

There are four power supply modules with different specifications to choose from, according to the site requirements e.g. flexible voltage input range, DC input power, output voltages and current rating.

| Item | | 2MLR-AC12 | 2MLR-AC22 | 2MLR-AC13 | 2MLR- AC23 | 2MLR-DC42 |
|------------------------------------|---|--|-------------|----------------|--------------------|-----------------|
| Input | Rated input voltage | 110 VAC | 220 VAC | 110 VAC | 220 VAC | 24 VDC |
| | Input voltage range | 85V~132VAC | 176V~264VAC | 85V~132VAC | 176V~264VAC | 19.2 ~ 28.8 VDC |
| | Input frequency | 50 / 60 Hz (47 ~ 63 Hz) | | | - | |
| | Max. input power | 110 VA / 42 W | | 176 VA / 72 W | | - |
| | Inrush current | 20A peak and lower (within 8 ms) | | | 80A peak and lower | |
| | Efficiency | 65% or higher | | | | |
| | Input fuse | Built in(not replaceable by a user) - AC power: 250V / 3.15A (Time-lag Type) UL approved - DC power: 125V/10A (Time-lag type) UL approved | | | | |
| Allowed instantaneous interruption | Within 20 ms | | | | | |
| Output | Output voltage | 5VDC (±2%) | | | | |
| | Output current | 5.5A | | 8.5A | | 7.5A |
| | Output power | 27.5W @ 55℃ | | 46.75W @ 55℃ | | 37.5W @ 55℃ |
| | Over current protection | 6.0 A ~ 13.0 A | | 9.3 A ~ 17.0 A | | 9.0 A~17.0 A |
| Relay Output | Purpose | RUN contact (refer to 8.2) | | | | |
| | Rated switching voltage/current | 24VDC, 0.5A | | | | |
| | Min. switching load | 5VDC, 1 mA | | | | |
| | Response time | Off→On/ On→Off: 10 ms and lower/12 ms and lower | | | | |
| Life | Mechanical life: 20 million and more times, electrical life: rated switching current: 100 thousand and more times | | | | | |
| Voltage status display | LED On when output voltage is normal | | | | | |
| Specification of cable | 0.75 ~ 2 mm ² | | | | | |
| Available clamped terminal | RAV1.25-3.5, RAV2-3.5 | | | | | |
| Dimension (W x H x D mm) | 55 x 95 x 90 | | | 55 x 95 x 110 | | |
| Weight | 326g | 382g | 334g | 384g | 417g | |

| | |
|-----------------------------------|------------------------------------|
| Applied base and install position | Power part of basic/extension base |
|-----------------------------------|------------------------------------|

Battery Specifications

| Item | Specifications |
|-------------------------|---|
| Nominal voltage/current | DC 3.0V / 1,800mAh |
| Warranty period | 5 years (at ambient temperature) |
| Purpose | Program and data backup, RTC operation when Power-OFF |
| Specification | Manganese dioxide lithium battery |
| Outer dimension (mm) | φ 17.0 X 33.5mm |

1.8 Base options (2MLI-CPUU)

There are four I/O base options to select from: 4 slot, 6 slot, 8 slot & 12 slot bases. The below specifications are applicable only for CPU model: 2MLI-CPUU

Main CPU base options

| Model Item | 2MLB-M12A | 2MLB-M08A | 2MLB-M06A | 2MLB-M04A |
|----------------|---------------|---------------|---------------|---------------|
| No of Modules | 12 modules | 8 modules | 6 modules | 4 modules |
| Dimension (mm) | 426 X 98 X 19 | 318 X 98 X 19 | 264 X 98 X 19 | 210 X 98 X 19 |
| Weight (kg) | 0.54 | 0.42 | 0.34 | 0.28 |

Expansion I/O base options

| Model Item | 2MLB-E12A | 2MLB-E08A | 2MLB-E06A | 2MLB-E04A |
|-----------------------------|------------------|------------------|------------------|------------------|
| No of Modules | 12 modules | 8 modules | 6 modules | 4 modules |
| Dimension (mm) | 426 X 98 X 19 | 318 X 98 X 19 | 264 X 98 X 19 | 210 X 98 X 19 |
| Weight (kg) | 0.59 | 0.47 | 0.39 | 0.33 |

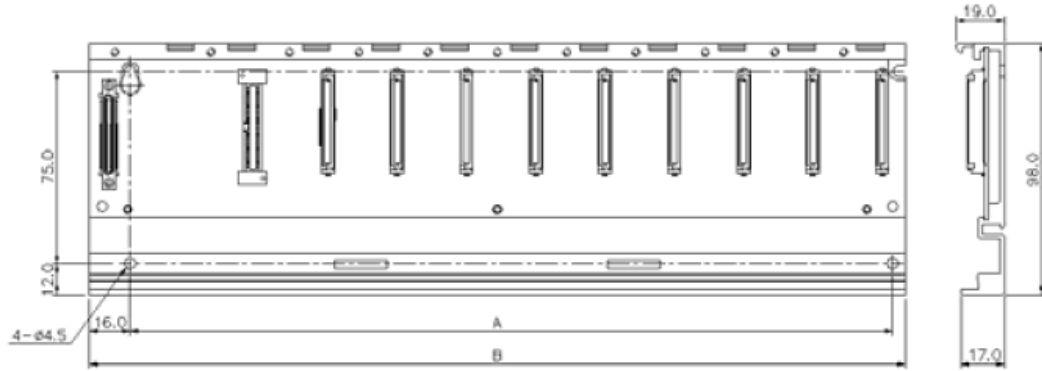
Expansion I/O cable options

| Model Item | 2MLC-E041 | 2MLC-E061 | 2MLC-E121 | 2MLC-E301 | 2MLC-E501 | 2MLC-E102 | 2MLC-E152 |
|-----------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Length (m) ⁺ | 0.40 | 0.60 | 1.20 | 3.00 | 5.00 | 10.00 | 15.0 |
| Weight (kg) | 0.15 | 0.16 | 0.22 | 0.39 | 0.62 | 1.20 | 1.80 |

⁺The total cable length between the CPU and the farthest I/O expansion base should not exceed 15m.

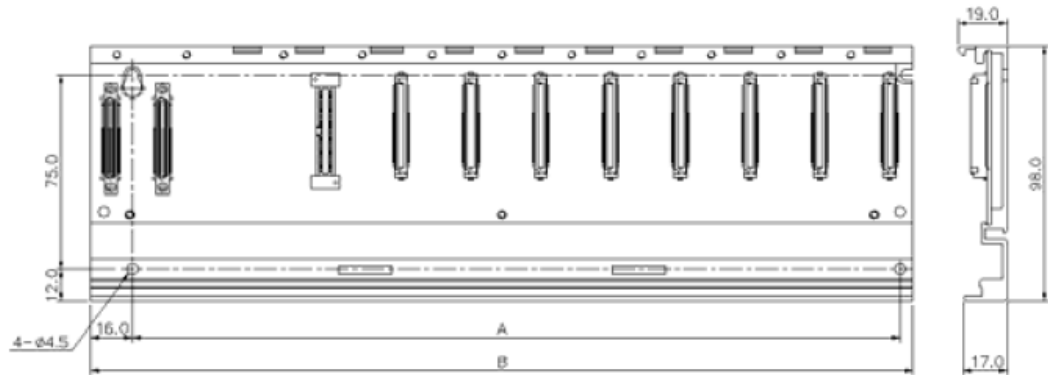
A. Main Base Board

(Unit: mm)



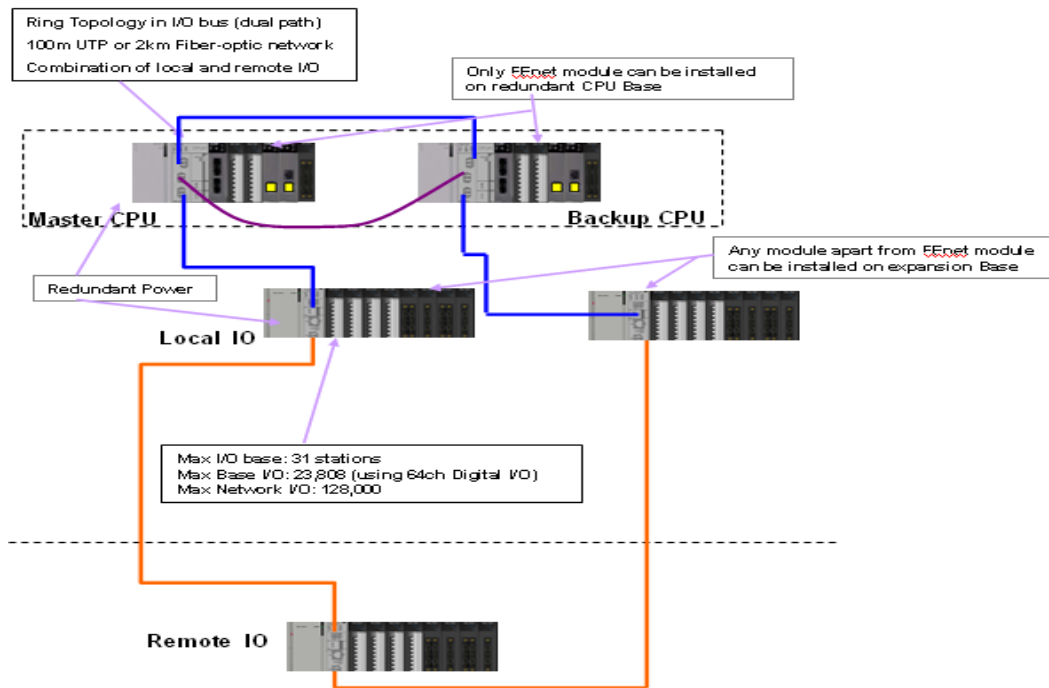
B. Expansion Base Board

(Unit: mm)



(Unit: mm)

1.9 Base Options (2MLR-CPUH/#)

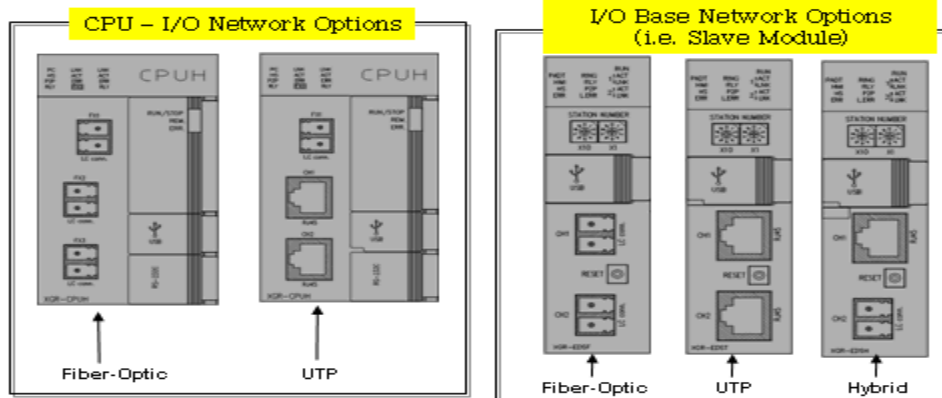


The above diagram demonstrates co-existence of both local I/O base and remote I/O base (i.e. UTP and fiber-optic cables) in a single I/O network.

**Please note that only FEnet module can reside on CPU Base.
 FEnet module can not be installed on the Expansion base.**

In redundant system employing CPU model: 2MLR-CPUH/#, Local I/O bases can communicate with the CPU via Industrial Ethernet using UTP CAT5 cable traveling up to a max 100m distance.

Remote I/O bases as far as 2km can communicate with the CPU on fiber-optic networks available in both CPU as well I/O base communication slave modules.



Main CPU base options

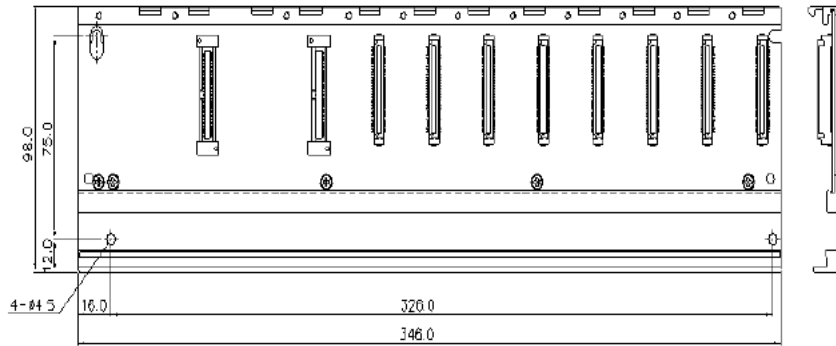
| Item | Model | 2MLR-M06P |
|--------------------------|-------|---------------|
| No of Modules | | 6 modules |
| Dimension (mm) | | 346 X 98 X 19 |
| Current Consumption (mA) | | 211 |
| Weight | | 0.34 kg |

Expansion I/O base options

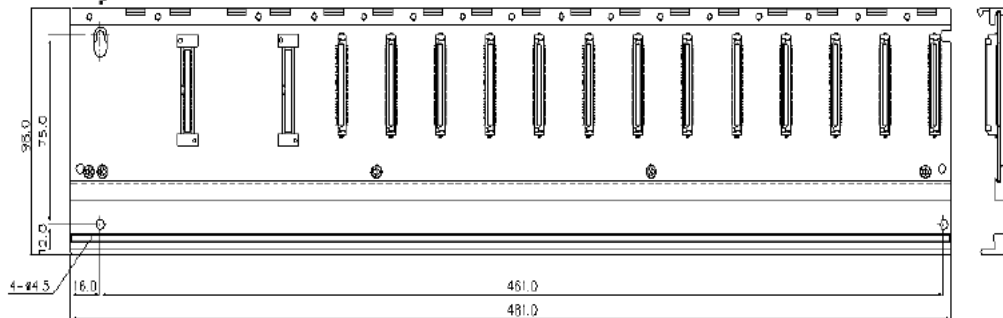
| Item | Model | 2MLR-E12P |
|--------------------------|-------|---------------|
| No of Modules | | 12 modules |
| Dimension (mm) | | 481 X 98 X 19 |
| Current Consumption (mA) | | 220 |
| Weight | | 0.59 |

(Unit: mm)

A. Main Base Board



B. Expansion Base Board



1.10 I/O Interface Modules (2MLR-CPUH/#)

| Item | Specification | | | Remarks |
|---------------------------------------|--|-------------------|------------------------------------|---------------------|
| | 2MLR-DBSF | 2MLR-DBST | 2MLR-DBSH | |
| Media | Optical | Electrical | Mixed | |
| Max. distance between Extension bases | Optical (2km) | Electrical (100m) | Optical (2km) Electrical (100m) | |
| Cable Spec | 62.5/125 Multi-mode Fiber LC type connector (Lucent Connector) Return Loss : over 45db | | | |
| Loader connection | Extension drive USB | | | |
| Range of station no. | 1 ~ 31 (other no. will generate an error) | | | No.0: not available |
| Install position | CPU parts(CPU0 connector) in extension base | | | |
| Weight (g) | 99 | 100 | 102 | |

2. Open networks

2.1 Network Summary Specifications

A wide range of open networking capability makes adds versatility to MasterLogic-200 PLC's scalable architecture. System engineers have an array of choices and features to design & construct a system architecture that is not just meeting the application but also renders high performance and bandwidth for future expansions.

| | | Fast Ethernet | Serial Comm | Profibus-DP |
|--------------------|--------------|---|--|--------------------|
| | | FEnet | Snet | Pnet |
| Modules | | 2MLL-EFMT (T.P) 2MLL-EFMF (F.O) | 2MLL-CH2A 2MLL-C22A 2MLL-C42A | 2MLL-PMEA |
| Transmission Speed | | 100/10Mbps | 300 ~ 11.5kbps | 9.6k ~12Mbps |
| Physical Layer | | IEEE802.3U - 100baseTx (T.P), 100baseFx (Fiber-Optic - Multi Mode) | RS232C / RS422 / 485 | RS485 |
| Distance | | 100m (Switch/Node , UTP/STP) 2Km (Switch/Node , Fiber Optic) | Max 500m (RS422/485) | Max 1.2Km |
| Max # of nodes | | 64 | 32 | 126 (32/segment) |
| Service / Protocol | HSL | √ (Peer-to-Peer) | - | √ (Profibus-DP) |
| | MLDP | √ (Experion Interface) | - | - |
| | Modbus slave | √ (MODBUS TCP slave) | √ (MODBUS RTU/ASCII slave) | - |
| | P2P | √ (MODBUS TCP master, User defined Protocol master) | √ (MODBUS RTU/ASCII master, User defined Protocol master) | - |

| | | | | |
|-------------------------------------|--|---|-----------------------|--|
| | SoftMaster I/F | ✓ | ✓ | |
| Configuration Software | SoftMaster-NM | | SoftMaster-NM & Sycon | |
| No of communication modules per CPU | Max 24 communication modules per CPU (Max 12 HSL services & 8 P2P services per CPU) | | | |
| Network Diagnostics | Auto-scan, Ping Test, Frame Monitor, Link Monitor, Loop back (as applicable) | | | |

HSL Service

High Speed Link can be defined as a communication service that performs bi-directional data transfers between:

- Two or more MasterLogic-200 PLCs (Peer-to-Peer)
- MasterLogic-200 and Profibus-DP devices (Pnet)

There can be a maximum of 12 HSL services per MasterLogic-200 CPU. Each HSL service can have a max of 128 blocks (either SEND or RECEIVE) and each block can handle of max of 200 words data size.

P2P Service (point to point)

P2P service can be defined as a communication service that performs:

- MasterLogic acting as MODBUS master and third-party open devices as MODBUS slave (MODBUS RTU/ASCII master on serial or MODBUS TCP master on Ethernet)
- MasterLogic acting as User-Defined Communication master and third-party proprietary devices as slave (both serial and Ethernet TCP-IP)

There can be a maximum of 8 P2P services per MasterLogic-200 CPU. Each P2P service can have a max of 64 blocks (either READ or WRITE).

2.2 Fast Ethernet (FEnet)



Overview

Open standard (IEEE802.3U) high speed Ethernet (FEnet) modules facilitate inter-connecting MasterLogic PLCs with either higher level computers or other peer PLCs on industrial Ethernet network. Network control uses industry standard Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol. Two types of modules are available to choose depending on the distance and cabling philosophy.

- Twisted pair (UTP/STP-CAT5) media with RJ45 connector (100m)
- Fiber-optic (x62.5/125um, Multi-mode) media with SC connector (2km)

They provide a variety of services / functions / protocols:

- Peer-to-Peer integration with other MasterLogic PLCs
- Experion integration via special MasterLogic Dedicated Protocol (MLDP)
- MODBUS TCP-IP master / slave protocols
- SoftMaster Interface
- User-defined Protocol for interfacing with third-party devices

Concurrent services

The above services are based on TCP-IP & UDP-IP protocols and thus many of the above processes can be concurrent, i.e. running at the same time in a single FEnet module. For example, a single FEnet module can be used for a) peer-to-

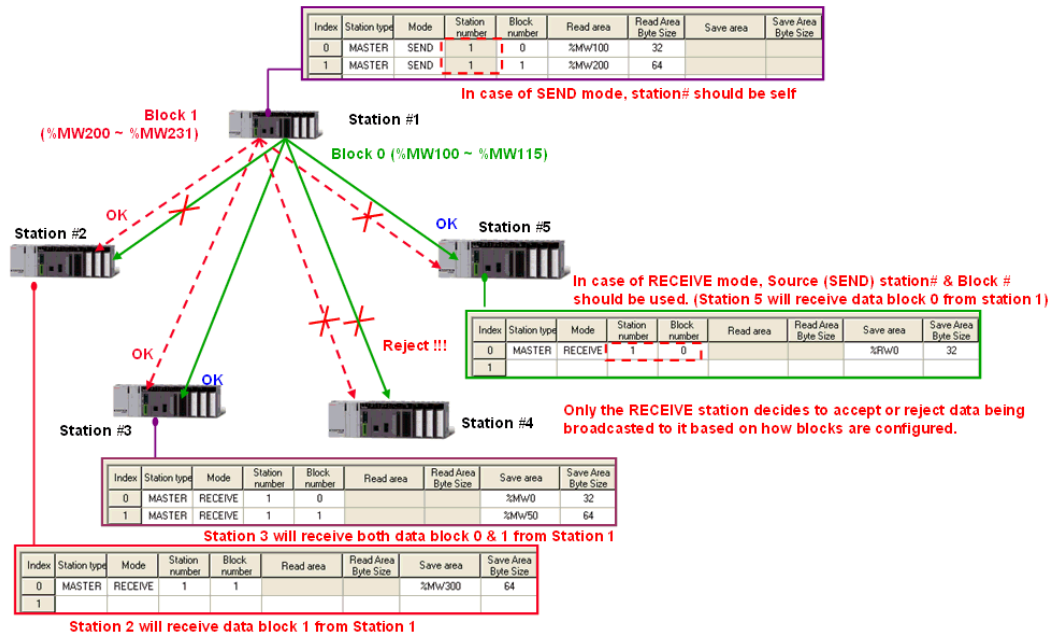
peer integration with other PLCs, b) Experion integration c) MODBUS TCP-IP master protocol d) SoftMaster I/F all at the same time. However, performance could be limited depending on the load.

Specifications

| | | Fast Ethernet | |
|--|-------------------------|---|---------------------------------------|
| Modules | | 2MLL-EFMT | 2MLL-EFMF |
| Ethernet Standard | | IEEE802.3U | |
| Protocol | | TCP-IP, UDP-IP | |
| Network Control Protocol (Access Method) | | CSMA/CD | |
| Software Firewall | | IP address settings in SoftMaster-NM | |
| Public Network Access | | DNS server and Gateway IP address setting | |
| Dynamic IP address for ADSL | | DHCP protocol | |
| Highway Topology (Transmission Method) | | Baseband | |
| Transmission Speed | | 10/100 Mbps | 100 Mbps |
| Physical Layer | | 100baseTx (T.P) | 100baseFx (Fiber-Optic) |
| Media | | UTP/STP, CAT5 (RJ45 connector) | x62.5/125um, Multi-mode, SC connector |
| Transmission Distance | | 100m (Switch/Node , UTP/STP) | 2Km (Switch/Node , Fiber Optic) |
| Max # of nodes | | 64 | |
| Service / Protocol | HSL | ✓ (Peer-to-Peer High Speed Link with other MasterLogic PLCs) | |
| | HSL Send/Receive blocks | 200 words / block, (Max. 128 blocks) | |
| | MLDP | ✓ (Experion Interface – MasterLogic Dedicated Protocol) | |
| | Modbus TCP slave | ✓ (MODBUS TCP slave protocol) | |
| | P2P | ✓ (MODBUS TCP master, User defined Protocol master) | |
| | SoftMaster I/F | ✓ | |
| Configuration Software | | SoftMaster-NM | |
| LEDs | | RUN, I/F, HS, P2P, PADT, PC, ERR, TX, RX, 10/100 | |
| Network Diagnostics | | Auto-scan, Ping Test, Frame Monitor, Link Monitor | |
| Current Consumption (mA) | | 410 | 630 |

| | | |
|------------|-----|-----|
| Weight (g) | 105 | 120 |
|------------|-----|-----|

HSL Service - Peer-to-Peer network of MasterLogic-200 PLCs



High Speed Link (HSL) services in Fast Ethernet module (FEnet) ensures efficient and reliable peer-to-peer networking of MasterLogic-200 PLCs.

In the above example, there are five PLCs (Station#1 ~ 5) configured for peer-to-peer network. Station#1 is configured with 2 “send” blocks which are broadcasted to rest of all the stations in the network. Only the station with “receive” blocks decides to accept or reject the broadcast packet based on parameters.

Read and Write parameters define the memory areas & size of data transfer for each block. Thus the engineer can configure and get peer-to-peer function working within a few minutes by few clicks and keys.

A max of 128 blocks can be configured in each HSL service and each block can handle of max of 200 words data size. Out of 128, a max of 64 blocks can be configured as “send” and the rest as “receive” blocks. A max of 64 MasterLogic

PLCs (stations) can be connected in a single network for peer-to-peer functionality.

MasterLogic Dedicated Protocol (MLDP) - Experion Integration

The high speed Ethernet communication modules (FEnet) of MasterLogic-200 system can reside on FTE network providing a high-level interface with Experion PKS servers.

MLDP (MasterLogic Dedicated Protocol) server embedded in these modules offer Experion servers, a special proprietary access on TCP-IP layer to various memory variables of the CPU. For more details on this interface, please refer to MasterLogic-Experion Integration section.

MODBUS TCP-IP Slave Protocol

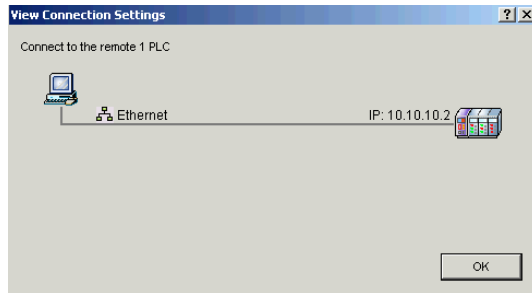
Instead of proprietary MLDP server protocol as above, the FEnet module can be configured to serve open standard MODBUS TCP-IP slave protocol for allowing any third-party controllers / HMI / SCADA to communicate with MasterLogic PLCs.

MODBUS Settings (read / write addresses) can be configured as per requirements.

| Function Code | Description | Modbus Address | Remarks | Response size* |
|---------------|---|---------------------|-----------|----------------|
| 01 | Output Contact Status Read (Read Coil Status) | 0XXXX (bit-output) | Bit read | 2000 coils |
| 02 | Input Contact Status Read (Read Input Status) | 1XXXX (bit-input) | Bit read | 2000 coils |
| 03 | Output Register Read (Read Holding Registers) | 4XXXX (word-output) | Word Read | 125 registers |
| 04 | Input Registers Read (Read Input Registers). | 3XXXX (word-input) | Word Read | 125 registers |

| | | | | |
|----|--|------------------------|------------|---------------|
| 05 | Output Contact 1 Bit Write (Force Single Coil) | 0XXXX (bit-output) | Bit write | 1 coil |
| 06 | Output Register 1 Word Write (Preset Single Register) | 4XXXX (word-output) | Word Write | 1 register |
| 15 | Output Contact Continuous Write (Force Multiple Coils) | 0XXXX (bit-output) | Bit Write | 1600 coils |
| 16 | Output Register Continuous Write (Preset Multiple Register) | 4XXXX (word-output) | Word Write | 100 registers |

SoftMaster I/F Service



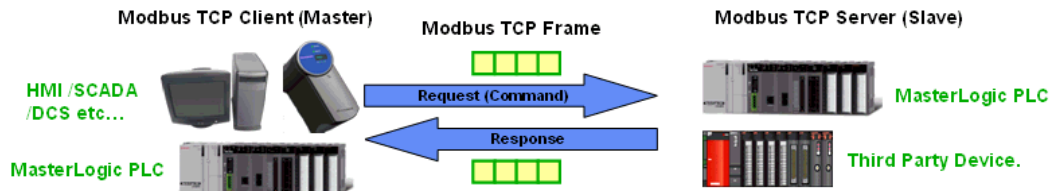
Every FEnet module has a ready built-in service for SoftMaster using TCP-IP Port 2002. This service is automatic and can be in the background along with other services.

Any SoftMaster application (programming software) can connect to the PLC via any of its FEnet module at any time

irrespective of other functions already being performed by the FEnet module.

P2P Service – MODBUS TCP-IP master

The same FEnet module can act as MODBUS TCP-IP master communicating with other third-party MODBUS TCP-IP slave devices, controllers, RTUs etc. In this architecture, MasterLogic PLC would be the master initiating read/write commands with other MODBUS TCP slave devices using TCP-IP port 502.



P2P Service – User-Defined Protocol

This is another unique feature in MasterLogic PLC. Some devices do not support open standard protocols such as MODBUS-TCP but only proprietary protocols providing access to special data areas / functions within the device.

MasterLogic PLC engineers do not fret during such situations. The FENet module allows configuring user-defined protocol using simple “Frame Editor” techniques to communicate with any third-party devices on special protocols.

Using “SoftMaster-NM” utility, “Send” and “Receive” frames can be configured with following options:

- Header, Data and Tail sections
- Numeric and String Constants
- Data frame with Fixed size & varying size variables
- Automatic BCC calculation
- Hex or ASCII conversions
- Transmitting frame controlled by user condition or system clock (100ms, 200ms, 1sec...)
- Receiving frame & writing to memory variable area is automatic

2.3 Serial Communication (Snet)



Overview

Like Ethernet, Serial Communication (Snet) modules add versatility and openness to MasterLogic architecture. Open standard RS232C/ RS422 / RS485 modules facilitate communication of MasterLogic PLCs with a wide range of serial devices i.e. RTU, panels, weigh bridges, barcode readers, high level computers or even other PLCs.

Three types of modules are available to choose depending on the distance and the partner device.

- Two ports of RS232C
- Two ports of RS422/485
- One RS232C port and one RS422/485 port

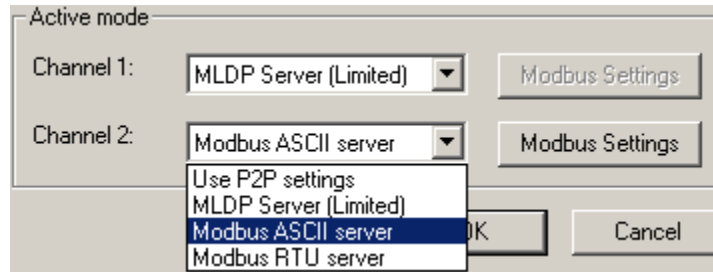
They provide a variety of services / functions / protocols:

- MODBUS RTU/ASCII master / slave protocols
- SoftMaster Interface
- User-defined Protocol for interfacing with third-party devices

Specifications

| | | Serial Interface (Snet) | | |
|--|--------------------------|---|------------------|--|
| Modules | | 2MLL-C22A | 2MLL-C42A | 2MLL-CH2A |
| Interface Standard | | RS232C – 2 ch | RS422/485 – 2 ch | 1 ch – RS232C 1 ch – RS422/485 |
| Modem connection with remote devices | | ✓ | - | ✓ (only on RS232C port) |
| Communication Settings (SoftMaster-NM) | Start Bit | 1 | | |
| | #Data Bits | 7 or 8 | | |
| | Stop Bits | 1 or 2 | | |
| | Parity | Odd/Even/None | | |
| Baud rate | | Options: 300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 bps | | |
| Synchronization | | Asynchronous | | |
| Transmission Distance | | 15m (extendable by modem / phone line) | 500m max | RS232C - 15m (extendable by modem) RS422 - 500m max |
| Network Configuration | | 1:1 | 1:1, 1:N, N:M | RS232C - 1:1 RS422 - 1:1, 1:N, N:M |
| Station No Setting | | Setting range : 0-31 (Max. station No. available : 32 stations) | | |
| Service / Protocol | Modbus RTU / ASCII slave | ✓ | | |
| | P2P | ✓ (MODBUS RTU/ASCII master, User defined Protocol master) | | |
| | SoftMaster I/F | ✓ | | |
| Configuration Software | | SoftMaster-NM | | |
| LEDs | | RUN, I/F, TX, RX, ERR | | |
| Network Diagnostics | | Auto-scan, Frame Monitor, Link Monitor, Loop back | | |
| Current Consumption (mA) | | 310 | 300 | 310 |
| Weight (g) | | 121 | 116 | 119 |

MODBUS RTU / ASCII Slave Protocol



The Snet module can be configured to serve open standard MODBUS RTU or ASCII slave protocol for allowing any third-party controllers / HMI / SCADA to communicate with MasterLogic PLCs.

MODBUS Settings (read / write addresses) can be configured as per requirements.

SoftMaster I/F Service

Every Snet module has a ready built-in service for SoftMaster software to connect to the PLC for program download / upload functions.

P2P Service – MODBUS RTU / ASCII master

The same Snet module can act as MODBUS RTU / ASCII master communicating with other third-party MODBUS slave devices, controllers, RTUs etc. In this architecture, MasterLogic PLC would be the master initiating read/write commands with other MODBUS slave devices.

| Channel | Operating Mode | P2P Driver |
|---------|-------------------|--|
| 1 | Modbus RTU server | |
| 2 | Use P2P | <div style="border: 1px solid black; padding: 2px;"> User frame definition MLDP client Modbus ASCII client Modbus RTU client </div> |

P2P Service – User-Defined Protocol

This is another unique feature in MasterLogic PLC. Some serial devices do not support open standard protocols such as MODBUS but only proprietary protocols providing access to special data areas / functions within the device.

Like the FEnet module, the Snet module allows configuring user-defined protocol using simple “Frame Editor” techniques to communicate with any third-party devices on special protocols.

Using “SoftMaster-NM” utility, “Send” and “Receive” frames can be configured with following options:

- Header, Data and Tail sections
- Numeric and String Constants
- Data frame with Fixed size & varying size variables
- Automatic BCC calculation
- Hex or ASCII conversions
- Transmitting frame controlled by user condition or system clock (100ms, 200ms, 1sec...)
- Receiving frame & writing to memory variable area is automatic

2.4 Profibus-DP (Pnet)

Overview

Pnet I/F module is one of the communication modules of MasterLogic-200 PLC system. It uses token ring topology to control the communication and configure the network. Pnet I/F module uses a shielded Twisted Pair Copper Cable to control the fieldbus

This module has the following characteristics

- Conforms to the international standard of EN 50170
- Supports Auto Baud Rate Detect
- Supports Sync/Freeze mode
- Maximum data input: 64 Bytes/Slave
- Maximum data output: 64 Bytes/Slave
- Maximum data size: 128 Bytes/Slave, 6 KB/Master
- Communication speed: 9.6K, 19.2K, 93.7K, 187.5K, 500K, 1.5M, 3M, 6M, 12M

Specifications

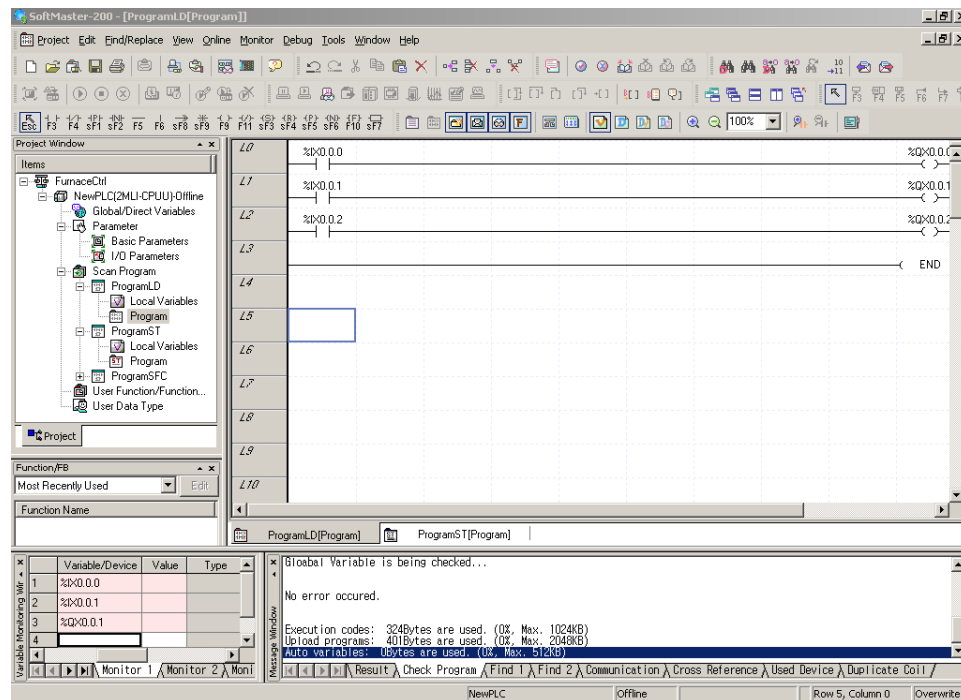
| Profibus-DP (Pnet) | |
|--------------------|-------------------|
| Module Type | Master |
| Network Type | Profibus-DP |
| Standard | EN50170/DIN19245 |
| Interface | RS-485 (Electric) |
| Transmission Route | Bus type |
| Modulation Type | NRZ |

| MAC | Local Token Ring | |
|---|------------------------------------|--------------------------|
| Max. Distance & Transmission Speed | Distance (m) | Transmission Speed (bps) |
| | 1,200 | 9.6K/19.2K/93.7K/187.5K |
| | 400 | 500K |
| | 200 | 1.5M |
| | 100 | 3M/6M/12M |
| Max. number of stations per Profibus network | 126 | |
| Max. number of stations per segment | 32 (including master & repeater) | |
| Cable used | Electric-twist shielded pair cable | |
| Max. communication size | 7 Kbytes | |
| Max. size per slave | 244 bytes | |
| Max. number of Profibus-DP Master Modules per CPU | 12 | |
| Configuration Tool | SoftMaster-NM, SyCon | |
| Current Consumption (mA) | 550 | |
| Weight (g) | 114 | |

3. SoftMaster

Overview

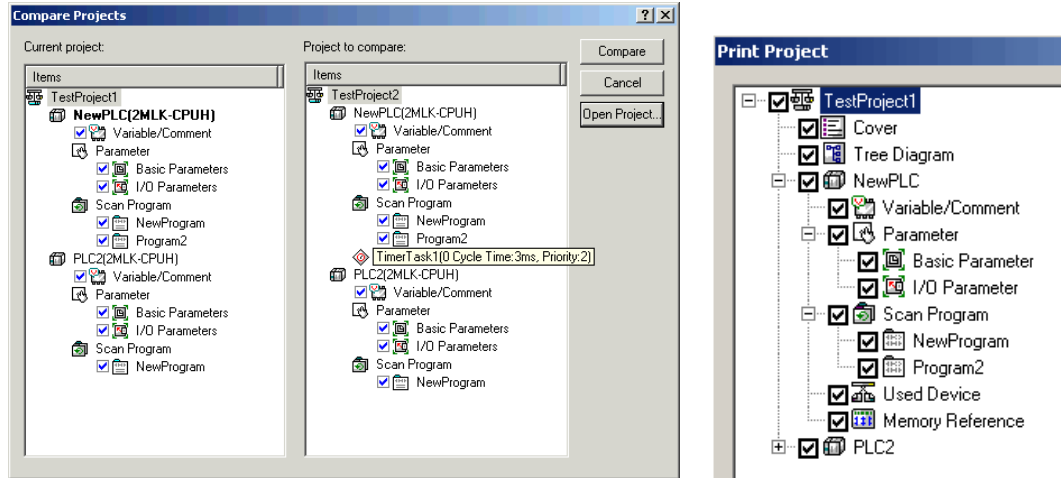
SoftMaster is a software tool designed to program and debug MasterLogic 200. It provides integrated PLC programming environment.



Project Management

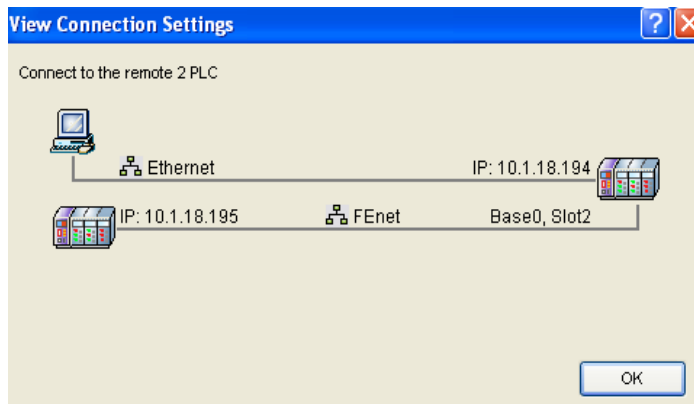
- Program multiple PLCs through a single window
- One project file (.xgp) as central storage for complete PLC info
- Compare project files to detect minor differences

- Import / Export entire PLC or selectively individual component
- Flexible documentation – entire PLC data or selectively



Options to connect to PLCs

- USB, RS232C, Ethernet (TP or Fiber-optic)
- Direct connection to PLC or two levels of remote connection to PLC via a communication module



User defined function blocks

SoftMaster in association with MasterLogic-200 CPU allows the creation of password protected user defined function blocks. A user can build the custom logic & strategies in these function blocks using configurable input and output parameters & data types. These user defined function blocks can be password protected for security and copyright purposes

User defined data types

SoftMaster allows the creation of user defined data types in addition to the standard IEC data types.

Monitoring

When SoftMaster is in connected mode, it allows monitoring of the below functions:

1. Program Monitoring
2. Variable Monitoring
3. System Monitoring
4. Address Monitoring
5. Special Module Monitoring
6. Trend Monitoring
7. Data Traces

Debugging

SoftMaster allows program debugging with advanced features like Step Over, Step Into, Step Out and Conditional Breakpoints.

Online

SoftMaster provides the following features when it is connected with PLC:

1. Online Editing
2. Write programs to PLC
3. Read programs from PLC
4. Change Operation Mode (RUN/STOP/DEBUG)
5. Reset / Clear PLC

6. View PLC information / history / errors and warnings
7. Specify Flash Memory Setting
8. Forced I/O / Skip I/O Setting
9. Fault Mask Setting
10. Online Module Replacement

Simulation

Simulation allows an engineer to programs without PLC, or debug program by using input condition setting or module simulation function.

The following features are supported by the simulation environment:

1. Program simulation
The program written in LD/SFC/ST can be simulated. Online editing and debugging is supported by the simulation environment.
2. PLC online function
The program monitoring and online diagnostic functions (e.g. system monitoring / device monitoring) can be used during simulation.
3. Module simulation
Digital I/O module, A/D conversion module, D/A conversion module, High counter, Temperature control module can be simulated.
4. I/O input condition setting
Simulation environment supports setting device value or channel value of the I/O module as an input condition.

System Requirements

| System Configuration | Minimum |
|-----------------------------|-------------------------------|
| Processor | 2.0 GHz Pentium IV or faster |
| RAM | 128 MB |
| Video Resolution | 1024 x 768 |
| Hard Drive | 10 GB |
| Operating System | Windows XP/SP2, Windows Vista |
| External Interface | RS232 Serial or USB |

4. Model Numbers

4.1 CPU modules

| Product | Model | Description | Remarks |
|------------|-------------|--|---------|
| CPU Module | 2MLI-CPUU | High speed CPU module (Fully Non-redundant system) (Max. I/O point: 6,144 points) | |
| | 2MLR-CPUH/T | High speed CPU module (Fully Redundant system), Master, TP/CAT5 (Max. I/O point: 23,808 points) | |
| | 2MLR-CPUH/F | High speed CPU module (Fully Redundant system), Master, Fiber Optic (Max. I/O point: 23,808 points) | |

4.2 I/O base, cables (2MLI-CPUU)

| Product | Model | Description | Remarks |
|--|-----------|----------------------------|---------|
| Main CPU Base (only for 2MLI-CPUU) | 2MLB-M04A | For 4 module installation | |
| | 2MLB-M06A | For 6 module installation | |
| | 2MLB-M08A | For 8 module installation | |
| | 2MLB-M12A | For 12 module installation | |
| Expansion I/O Base (only for 2MLI-CPUU) | 2MLB-E04A | For 4 module installation | |
| | 2MLB-E06A | For 6 module installation | |
| | 2MLB-E08A | For 8 module installation | |
| | 2MLB-E12A | For 12 module installation | |

| Product | Model | Description | Remarks |
|---|-----------|---|---|
| Power module (only for 2MLI-CPUU) | 2MLP-ACF1 | AC 100V~240V input, DC 5V: 3A, DC 24V: 0.6A | |
| | 2MLP-ACF2 | AC 100V~240V input DC 5V: 6A | |
| | 2MLP-AC23 | AC 100V~240V input DC 5V: 8.5A | |
| | 2MLP-DC42 | DC 24V Input DC 5V: 6A | |
| Expansion I/O cable (only for 2MLI-CPUU) | 2MLC-E041 | Length: 0.4m | Total extension distance should not exceed 15m |
| | 2MLC-E061 | Length: 0.6m | |
| | 2MLC-E121 | Length: 1.2m | |
| | 2MLC-E301 | Length: 3.0m | |
| | 2MLC-E501 | Length: 5.0m | |
| | 2MLC-E102 | Length: 10.0m | |
| | 2MLC-E152 | Length: 15.0 m | |

4.3 I/O base, I/O interface modules, cables (2MLR-CPUH)

| Product | Model | Description | Remarks |
|---|-----------|------------------------------------|---------|
| Main CPU Base (for 2MLR- CPUH/T, 2MLR- CPUH/F) | 2MLR-M06P | CPU base for 6 module installation | |

| Product | Model | Description | Remarks |
|--|-----------|--|---------|
| Expansion I/O Base (for 2MLR-CPUH/T, 2MLR-CPUH/F) | 2MLR-E12P | I/O Base for 12 module installation | |
| Power module (for 2MLR-CPUH/T, 2MLR-CPUH/F) | 2MLR-AC13 | Power Module, 8.5A, Voltage (AC110V) | |
| | 2MLR-AC23 | Power Module, 8.5A, Voltage (AC220V) | |
| | 2MLR-AC12 | Power Module, 5.5A, Voltage (AC110V) | |
| | 2MLR-AC22 | Power Module, 5.5A, Voltage (AC220V) | |
| | 2MLR-DC42 | Power Module, 7.5A, Voltage (DC24V) | |
| I/O interface modules (for 2MLR-CPUH/T, 2MLR-CPUH/F) | 2MLR-DBSF | I/O Interface Module, Fiber Optic | |
| | 2MLR-DBST | I/O Interface Module, TP/CAT5 | |
| | 2MLR-DBSH | I/O Interface Module, Hybrid (Fiber Optic & TP/CAT5) | |

4.4 Digital I/O modules

| Product | Model | Description | Remarks |
|----------------------|-----------|---|---------|
| Digital Input Module | 2MLI-D21A | DC 24V Input, 8 point (Current source / sink input) | |
| | 2MLI-D22A | DC 24V Input, 16 point (Current source / sink input) | |
| | 2MLI-D24A | DC 24V Input, 32 point (Current source / sink input) | |

| Product | Model | Description | Remarks |
|-----------------------------|-----------|---|---------|
| | 2MLI-D28A | DC 24V Input, 64 point (Current source / sink input) | |
| | 2MLI-D22B | DC 24V Input, 16 point (Current source input) | |
| | 2MLI-D24B | DC 24V Input, 32 point (Current source input) | |
| | 2MLI-D28B | DC 24V Input, 64 point (Current source input) | |
| | 2MLI-A12A | AC 110V input, 16 point | |
| | 2MLI-A21A | AC 220V input, 8 point | |
| Digital Output Module | 2MLQ-RY1A | Relay output, 8 point (for 2A, single COM.) | |
| | 2MLQ-RY2A | Relay output, 16 point (for 2A) | |
| | 2MLQ-RY2B | Relay output, 16 point (for 2A), Varistor included | |
| | 2MLQ-TR2A | Transistor output, 16 point (for 0.5A, Sink output) | |
| | 2MLQ-TR4A | Transistor output, 32 point (for 0.1A, Sink output) | |
| | 2MLQ-TR8A | Transistor output, 64 point (for 0.1A, Sink output) | |
| | 2MLQ-TR2B | Transistor output 16 point (for 0.5A, Source output) | |
| | 2MLQ-TR4B | Transistor output 32 point (for 0.1A, Source output) | |
| | 2MLQ-TR8B | Transistor output 64 point (for 0.1A, Source output) | |
| | 2MLQ-SS2A | Triac output, 16 point (for 0.6A) | |

4.5 Analog I/O, HSC Modules

| Product | Model | Description | Remarks |
|---------------------------|------------|---|---------|
| Analog Input modules | 2MLF-AV8A | <ul style="list-style-type: none"> Voltage Input: 8 channels DC 1 ~ 5V / 0 ~ 5V / 0 ~ 10V / -10 ~ +10V | |
| | 2MLF-AC8A | <ul style="list-style-type: none"> Current Input: 8 channels DC 4 ~ 20mA / 0 ~ 20mA | |
| | 2MLF-AD8A | <ul style="list-style-type: none"> Voltage/Current Input: 8 channels | |
| | 2MLF-AD16A | <ul style="list-style-type: none"> Voltage/Current Input: 16 Channels | |
| | 2MLF-AD4S | <ul style="list-style-type: none"> Voltage/Current Input: 4 channels Isolation between channels | |
| Analog Output modules | 2MLF-DV4A | <ul style="list-style-type: none"> Voltage Output: 4 channels DC 1 ~ 5V / 0 ~ 5V / 0 ~ 10V / -10 ~ +10V | |
| | 2MLF-DC4A | <ul style="list-style-type: none"> Current Output: 4 channels DC 4 ~ 20mA / 0 ~ 20mA | |
| | 2MLF-DC4S | Current Output: 4 channels, Isolation between channels | |
| | 2MLF-DV8A | <ul style="list-style-type: none"> Voltage Output: 8 channels DC 1 ~ 5V / 0 ~ 5V / 0 ~ 10V / -10 ~ +10V | |
| | 2MLF-DC8A | <ul style="list-style-type: none"> Current Output: 8 channels DC 4 ~ 20mA / 0 ~ 20mA | |
| Thermocouple Input Module | 2MLF-TC4S | Temperature (T/C) Input, 4 channels, Isolation between channels | |
| RTD Input Module | 2MLF-RD4A | Temperature (RTD) Input, 4 channels | |
| High speed Counter Module | 2MLF-HO2A | <ul style="list-style-type: none"> Voltage Input type (Open Collector type) 200 kHz, 2 channel | |
| | 2MLF-HD2A | <ul style="list-style-type: none"> Differential Input type (Line Driver type) 500 kHz, 2 channel | |

4.6 Communication Modules

| Product | Model | Description | Remarks |
|--|-----------|--|---------|
| FEnet Module (Optical/ Electrical) | 2MLL-EFMF | <ul style="list-style-type: none"> Fast Ethernet (multi-mode fiber-optic media), Master 100/10Mbps support | |
| | 2MLL-EFMT | <ul style="list-style-type: none"> Fast Ethernet (CAT 5 media), Master 100/10Mbps support | |
| Snet Module | 2MLL-C22A | <ul style="list-style-type: none"> Serial communication RS-232C, 2 channels | |
| | 2MLL-C42A | <ul style="list-style-type: none"> Serial communication RS-422 (485), 2 channels | |
| | 2MLL-CH2A | <ul style="list-style-type: none"> Serial communication RS-232C 1 Channel / RS-422 (485) 1 Channel | |
| Profibus-DP Module | 2MLL-PMEA | Profibus-DP Master Module | |

4.7 Programming Cables

| Product | Model | Description | Remarks |
|-----------|----------|--------------------------------|---------|
| USB cable | USB-301A | Programming cable for USB port | |

4.8 Software Environment

| Product | Model | Description | Remarks |
|---------|-------|-------------|---------|
|---------|-------|-------------|---------|

| | | | |
|---|----------|--|--|
| SoftMaster | SSS-MLPT | Programming tool for MasterLogic PLC | |
| Experion PKS Interface Driver (Not required for Experion HS / LS) | SSS-MLDP | Driver for integration with Experion PKS | |

4.9 Others

| Product | Model | Description | Remarks |
|--------------|-----------|--|---------|
| Terminator | 2MLT-TERA | Must use for base expansion | |
| Dummy module | 2MLT-DMMA | Dust protection module for unused slot | |

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