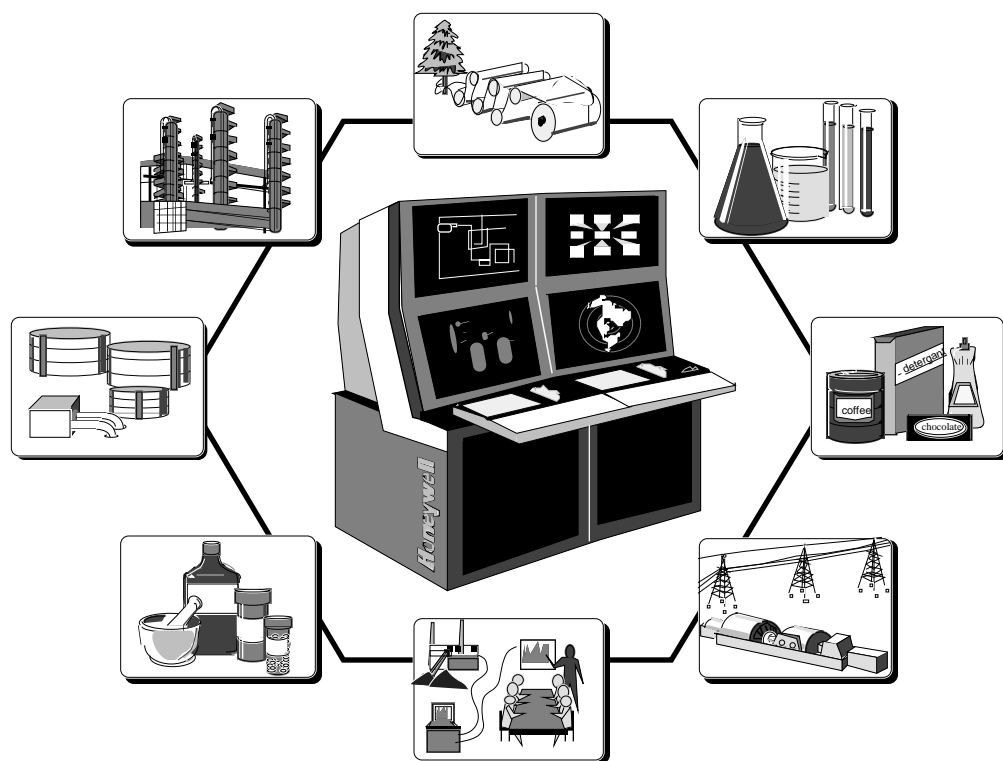


Logic Manager Specification and Technical Data

LM03-500
R500
9/95



TDC 3000X Logic Manager

Specification and Technical Data

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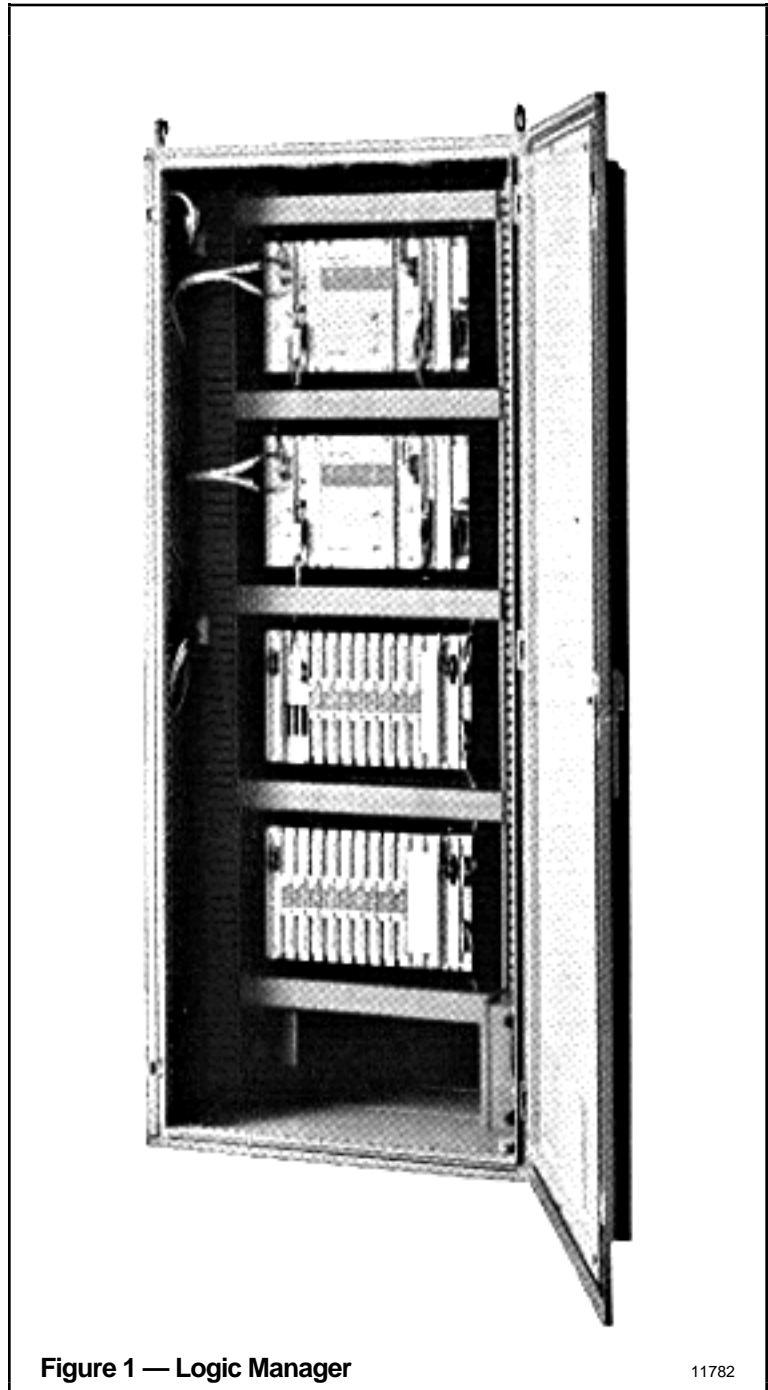


Figure 1 — Logic Manager

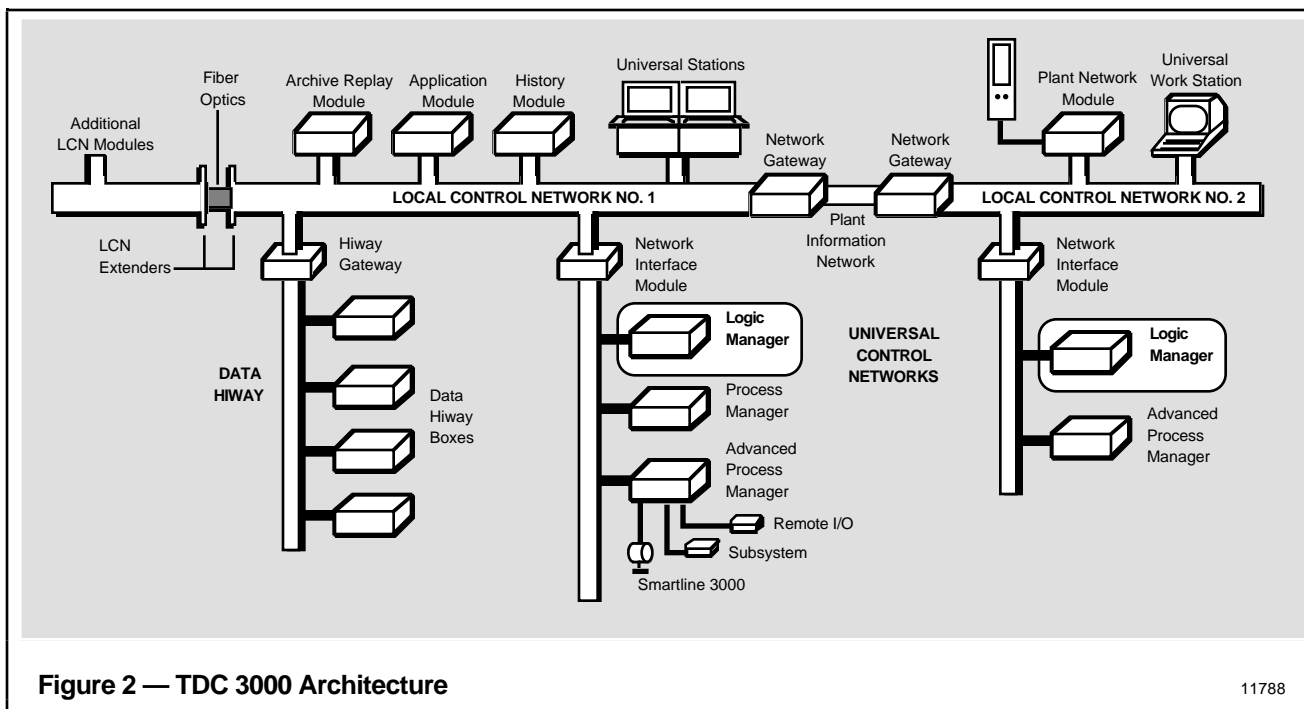


Figure 2 — TDC 3000 Architecture

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Introduction

Logic Manager (LM) provides high-speed logic functions on the Universal Control Network (UCN). In keeping with Honeywell's philosophy of consistent product evolution, the Logic Manager adds yet another increment of power to the TDC 3000 advanced system for industrial control. Now fast logic functions are integrated into the architecture of the Universal Control Network to support integrated operations and control. The result is increased performance at lower cost for applications requiring

- fast logic program execution,
- extensive digital, Boolean, or interlock logic, and
- ease of ladder logic programming.

Because of its position on the Universal Control Network, as shown in Figure 2, the Logic Manager shares some of the same important features as its UCN peers—the Process Manager (PM) and Advanced Process Manager (APM). This includes

- direct peer-to-peer communication with other Logic Managers, Process Managers, and Advanced Process Managers (initiated by either an LM or PM),
- full communication with operators, engineers, and maintenance personnel at the Universal Stations,
- support of higher level strategies through communication with Application Modules and host computers on the Local Control Network, and
- database restoration from the History Module.

Universal Control Network

The Universal Control Network, a local area network introduced to TDC 3000 in 1988, provides the communication channel for the Logic Manager. The UCN features a 5 megabit/second, carrier band, token bus network, designed to be compatible with IEEE* and

* Institute of Electrical and Electronics Engineers

ISO** standards. UCN communications are consistent with the growth and direction of evolving international standards and industrial specifications such as real time MAP, with additional Honeywell extensions to assure secure process control applications.

Up to 32 redundant devices are supported by the UCN, which consists of redundant coaxial cables. The peer-to-peer communication capability enables the sharing of information between all Logic Managers, Process Managers, and Advanced Process Managers on the network, thereby facilitating the implementation of coordinated advanced control strategies.

Network Interface Module

The Universal Control Network is connected to the Local Control Network through the Network Interface Module. The NIM makes the necessary conversion between the transmission

** International Standards Organization

techniques and protocols used by the two networks. Data, alarms, and messages from the UCN devices are forwarded by the NIM to the appropriate modules on the LCN. Databases are configured at the Universal Station, stored in the History Module and then loaded to the UCN devices by way of the NIM. NIM redundancy is an available option.

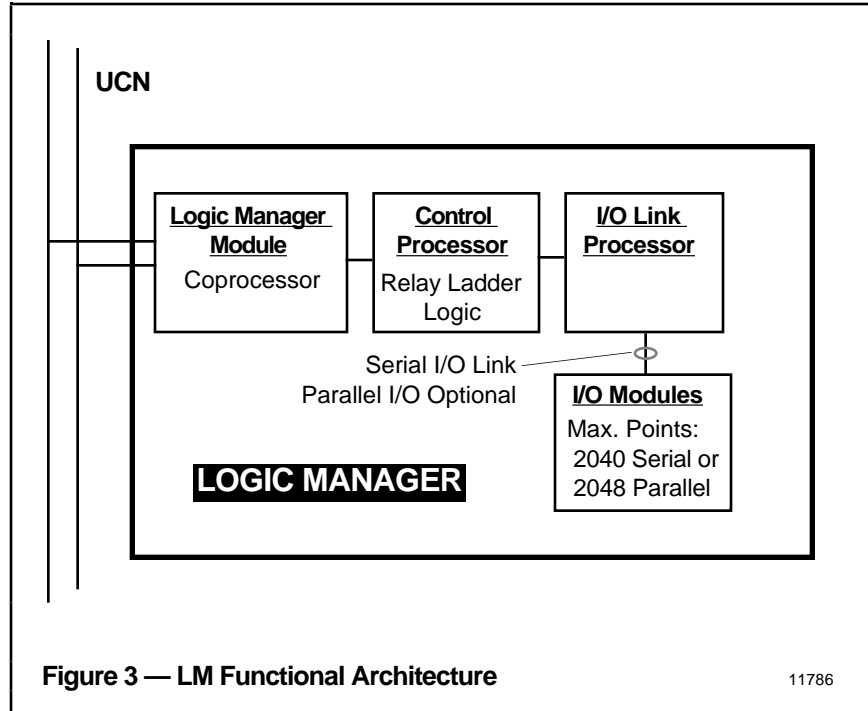
Functional Description

Functional Overview

The primary function of the Logic Manager is to provide rapid execution of logic-type operations. At the same time, its interface to the Universal Control Network enables the Logic Manager to readily share data with its peers—Process Managers and Advanced Process Managers, as well as other Logic Managers. As shown in Figure 3, the LM consists of a coprocessor known as the Logic Manager Module (LMM) that serves as the UCN interface, a Control Processor executing ladder logic, and an I/O Link Processor collecting data from a serial or parallel I/O subsystem.

The LM Control Processor rapidly and continuously reads the process inputs and executes the user-written ladder logic program. Typical speeds are in the 50 millisecond range from input switch closure to contact output. I/O data is stored in the Control Processor's I/O data tables, as illustrated in Figure 4.

Operating on a scan cycle that is independent of the Control Processor ladder logic cycle, the LMM collects and processes information to and from the relay ladder logic. The LMM converts this data to UCN data types (Tag.Parameter), performing engineering unit conversion, alarm handling, annunciation, diagnostic status reporting, and UCN communication functions.



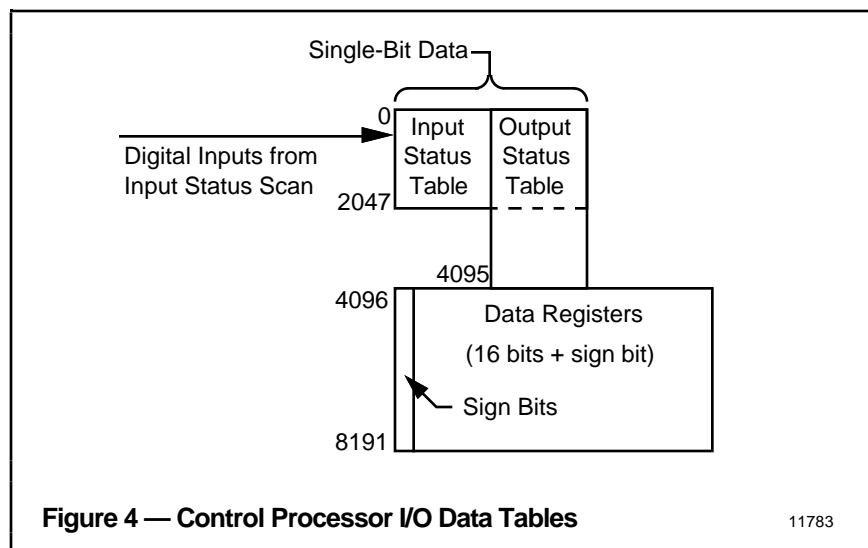
The normal LMM scan cycle is 1/2-second (see Table 1). Operator changes from the Universal Station are written immediately to the LM Control Processor. As mentioned previously, typical LM Control Processor control cycles are in the 50-millisecond range.

The Logic Manager Module database is configured from the Universal Station. The ladder logic program is developed using the Logic Manager MS-DOS™ Loader/Terminal or PC Loader (described under **Options**). Once

loaded into the Logic Manager, ladder logic programs can be saved on the History Module, and downloaded over the UCN to the Logic Manager. Multiple ladder logic programs can be saved under separate file names on the History Module.

In addition to integration of Logic Manager data points into standard Universal Station operating displays, some additional displays

™ MS-DOS is a registered trademark of Microsoft Corporation.



are available for maintenance. All diagnostic information that is provided in the Logic Manager is available at the US.

Data Point Types

Nine operator-displayable point types can be configured for the Logic Manager:

- Digital Input
- Digital Output
- Digital Composite
- Analog Input
- Analog Output
- Linkage
- Flag
- Numeric
- Timer

Note that these **data points** are configured uniquely for the Logic Manager Module. The user assigns these points to the field I/O points that are read and stored in the Control Processor Data Tables described earlier, or to internal registers and coils. In many cases, such as in Digital Composite points, multiple I/O points will be combined into a single LM point for greater meaning on the operator display. Some field points will not require associated Logic Manager points. Therefore, the number of different types of data points configured for the Logic Manager may differ from the actual numbers of I/O points connected to the I/O modules.

Digital Input

A Logic Manager digital input (DI) can be acquired from any designated status location within the LM Control Processor memory. Typically, it would be mapped to an Input Status Table address that contains the status of a process connection. Scan time is fixed at twice per second, and up to 1866 digital input points can be processed.

Digital Output

A digital output (DO) request from an operator or system device is passed directly to the Control Processor for immediate processing. The request is written into the designated memory location—normally the Output Status Table. The Logic Manager Module monitors the Control Processor point, and places the latest status in the LMM's "current status" table. Up to 1950 digital outputs points can be processed at a fixed rate of twice per second.

Digital Composite

Digital composite (DC) points are multi-input/multi-output digital points. They provide an improved view of the process to the operator. They are primarily faceplates to display motor control functions implemented in the relay ladder logic program. Figure 5

shows a diagram representing the major parameters associated with this type of point. It shows how the commanded state is passed from the LMM to the Control Processor, where it can be processed by the ladder logic program. Permissives and interlocks, if built into the Control Processor logic, are communicated to the LMM where they can influence the resulting LMM output parameter (OP). Process feedback can be provided through one or two optional inputs (D1, D2). The status of a local manual switch can also be monitored to show if the outputs are being controlled by the Control Processor or by an external device. A maximum of 304 DC points can be implemented. Group, detail, and graphic display support of all point parameters is provided.

Analog Input

The LMM can be configured to process analog inputs (AIs) either once or twice per second. At the 1-second rate, up to 254 points can be accommodated; at the 1/2-second rate, 127 points can be accommodated.

Engineering unit conversion and limit checking is performed on each of these points. Alarms can be generated accordingly and there is provision for alarm deadbands.

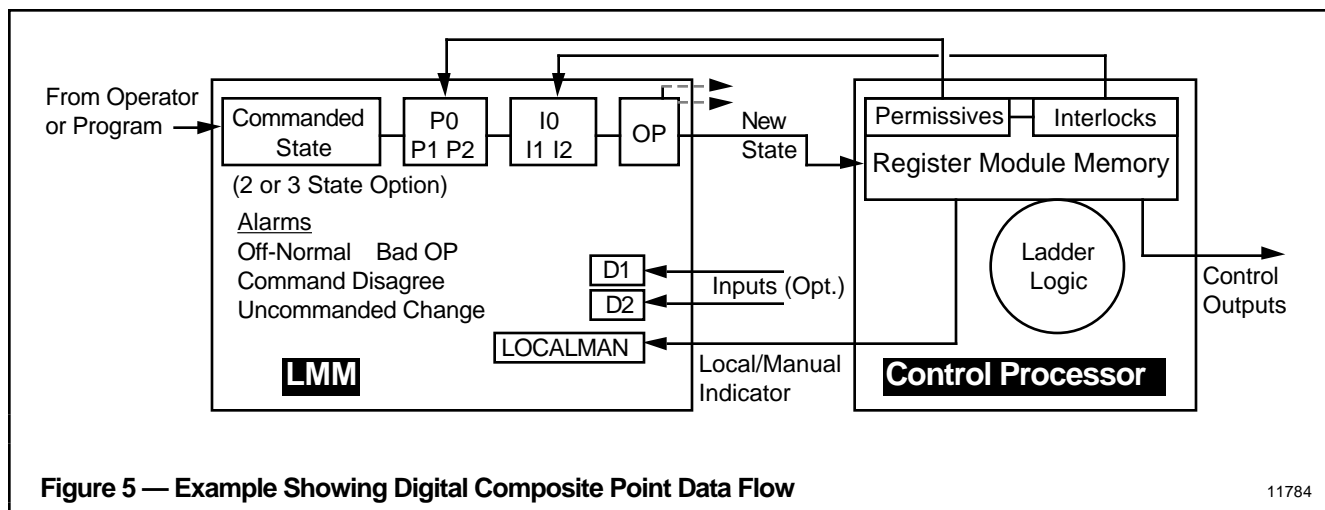


Figure 5 — Example Showing Digital Composite Point Data Flow

Analog Output

An analog output (AO) from the UCN is converted by the LMM to the Control Processor format, and then queued as a “write command” for the designated Control Processor register, to be processed during the next ladder logic scan. After the write command, the LMM reads the value from the Control Processor register and returns it to the LMM database for history, logging, or operator inquiry.

Like analog inputs, the LMM cycle for analog output points can be configured to process points either once or twice per second. Depending on this selection, the maximum number for analog outputs can be either 965 or 482, respectively.

Linkage

The function of the linkage point in the LM, also referred to as the “logic point,” is to transfer data between UCN and Control Processor connections. Any pairing is acceptable, and can include unsigned, integer, and real data formats. This point is the basis for the LM application-level support of peer-to-peer communications on the UCN. Each linkage point can accommodate 12 input connections and 12 outputs. UCN connections are limited to a maximum of 45 inputs and 50 outputs. Point processing takes place at 1/2-second intervals.

Flag

A flag point is a digital I/O point intended primarily for interprocess control. There may be up to 1024 flag points, the first 128 of which are considered to be in alarm when in the ON state.

Numeric

The numeric point provides for reading and writing of integer values, such as accumulations.

There may be up to 1024 numeric points, and they can be optionally configured with a unique tag name.

Timer

The timer point offers access to registers that are associated with relay ladder logic timers. The point controls the timer by writing to the Run Contact and Accumulator. Up to 700 timer points can be processed, and full control of the timer by the operator is supported.

Alarm System Functions

The Logic Manager supports many of the extensive alarming features of TDC 3000. As process alarms are detected, they are brought to the operator’s attention at the Universal Station through keyboard LEDs and a variety of displays including alarm summaries, alarm annunciator displays, group displays, and custom graphic displays. Contacts also are provided for connection of customer-supplied devices such as audible signals or external annunciators. Because alarms can be confined to selected areas or units, operators need not be subjected to alarms that do not relate to their specific assignments.

LM analog inputs can be configured for High/Low alarm detection, with a fixed deadband or engineering-unit deadband.

Alarm messages include the “Alarm Limit Exceeded” indication. Analog inputs that are connected to another configured tag, such as a regulatory slot in a PM, can have its alarms assigned to that tag, thereby providing a single interface to the operator. LM digital input points can be configured for “off-normal” alarms or for alarms triggered by a change in the process variable. Digital composite points provide for off-normal alarms for inputs. Where there are both inputs and outputs, Command Disagree alarms can be established. This provides for the situation where the actual state changes relative to the commanded state, as well as when the actual state fails to track the commanded state within a configurable time period.

Point Mix

The Logic Manager Module can be configured to process one or any combination of the point types, within the individual point-type maximum limits (Table 1), Control Processor constraints related to transfer table capacity, and the overall constraint of total allotted “processing units” (2800). The processing unit totals are calculated from processing unit values associated with each point type. Table 2 shows the calculations for a sample configuration.

Point Processing

Table 1 — Maximum Number of Each Data Point Type

Point Type	1/2 Second Scan Rate	1 Second Scan Rate
Digital Input	1866	N/A
Digital Output	1950	N/A
Digital Composite	304	N/A
Analog Input	127	254
Analog Output	482	965
Linkage	14	N/A
Flag	1024	N/A
Numeric	1024	N/A
Timer	700	N/A

Most data being transferred between the LMM and the Control Processor is updated on a 0.5-second scan cycle. In the case of analog inputs and outputs, more points can be processed by optionally assigning a 1-second scan rate (see Table 1). Actual ladder logic processing typically occurs at much faster rates.

Operator output changes are processed immediately by the Logic Manager Module and transferred to the Control Processor.

Physical Characteristics

Standard Configuration

The standard configuration for a Logic Manager consists of:

- a Processor card file, or “rack,” with the following modules:
 - Logic Manager Module
 - Control Processor Modules
 - Power Supply
 - Serial Link Module
 - Parallel Link Driver Module
- One or more I/O card files
- Standard UCN cabinet(s) enclosing the above files

Processor Card File (“Rack”)

Figure 6 illustrates the module positions for a single Logic Manager Processor 14-slot card file. In addition to the Logic Manager Module (2 slots), there is the LM Control Processor (5 slots), power supply (2 slots), Serial Link Modules (SLMs—1 optional), and a Parallel Link Driver Module (PLDM). Two slots are available for other optional modules. See the discussion under **Options** below.

I/O Card Files (“Racks”)

Table 2 — Point Configuration Example

Point Type	Point Quantity	Value/Point	Total Units
Digital Input	580	1.3	754
Digital Output	410	0.7	287
Digital Composite	50	9.2	460
Analog Input	31	11.0	341
Analog Output	20	2.9	58
Linkage	4	200.0	800
Timer	25	4.0	100
LMM Totals	1,120	—	2,800

The standard I/O card file, like the Processor file, has 14 slots. One slot is always reserved for a serial or parallel I/O module, a second slot is devoted to an Enhanced Diagnostic Module (EDM—checks for problems with data and control lines on the I/O bus), and one or two additional slots contain a power supply module. In addition to these and the I/O modules themselves, other special modules may be required for a specific configuration.

selection of I/O modules designed for connection to a variety of field devices. Included are modules for digital and analog inputs, digital and analog outputs, and special-function modules. The available module types are listed in tables at the back of this document.

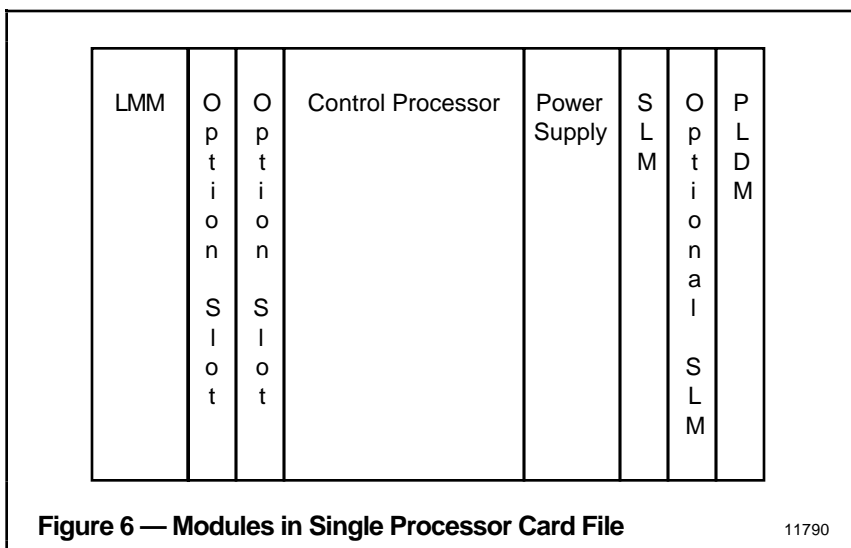
Serial I/O System

The remote serial I/O configuration allows I/O card files to be mounted close to the machine or process being controlled—at distances up to 10,000 feet from the LM Control Processor. This eliminates long multiple wire runs from the field devices to the area where the Control Processor is located. The RS485 communication link is 4-wire link, and operates full duplex at 115.2 kbaud. Serial I/O update is

Options

I/O Subsystems

Two types of I/O subsystems are supported by the Logic Manager—serial and parallel. Each of these accommodates a wide



independent of the Logic Manager Control Processor; therefore scan time is unaffected by serial I/O.

The communication interface module in a serial card file is known as the SIOM (Serial I/O Module). It is linked to the Serial Link Module in the Processor Card File. Each SLM operates two channels, and up to two SLMs may be installed within one Logic Manager Processor file. Each channel supports up to 16 I/O files or a maximum of 2040 I/O points. Each I/O slot of a serial I/O file can be configured to accommodate 0-, 8-, 16-, or 32-point I/O modules. Refer to the factory for recommended configurations.

Parallel I/O System

The Parallel I/O Subsystem is designed for those applications in which only short distances between the I/O files and the Control Processor are needed, and where redundancy is not required. Access time is extremely fast. The first I/O file of the local parallel I/O system is connected to the Parallel Link Driver Module in the Logic Manager Processor file. A PIOM (Parallel I/O Module) is installed in each I/O file. The LM supports 2048 I/O points and up to 22 card files in a parallel I/O configuration.

The PIOM allows any combination of 8-, 16-, or 32-point modules in an I/O file, providing the total number of I/O points does not exceed 2048. A 100-foot parallel transmission length is permitted with each Logic Manager system.

Logic Manager Redundancy

Logic Manager redundancy is a standard option. Processor file redundancy is achieved by the addition of a redundant Processor file, and equipping both primary and secondary files with a single-slot Redundancy Control Module (RCM). Figure 7 illustrates this arrangement. This supports

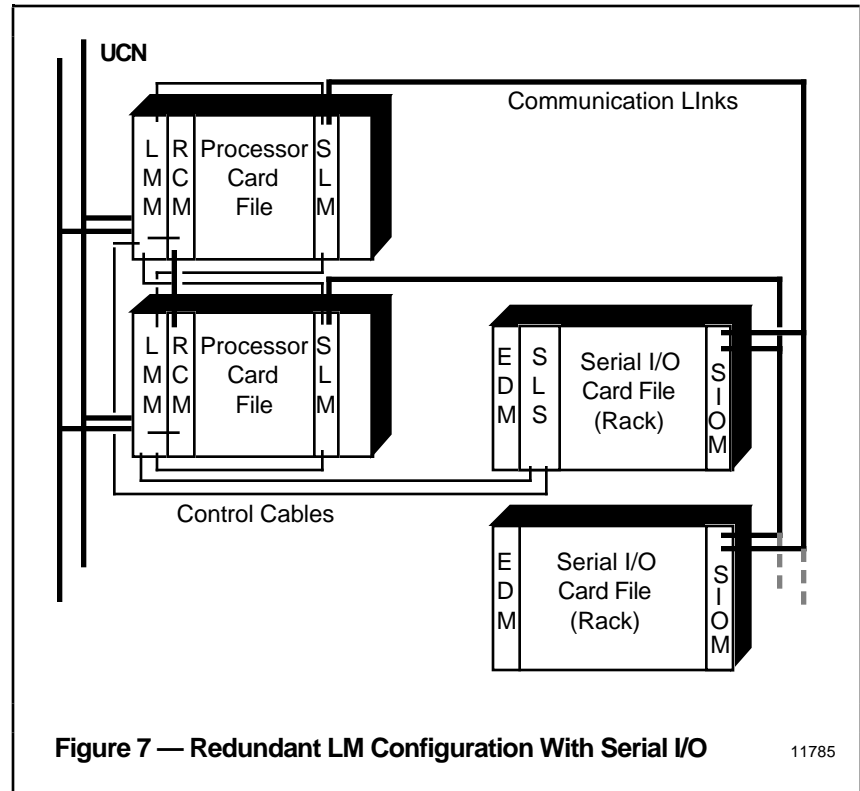


Figure 7 — Redundant LM Configuration With Serial I/O

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automatic switchover and backup in the event of LM primary failure. The RCMs track control data from primary to secondary, collect and process diagnostic information, and determine the primary/secondary states of the two Control Processors.

The primary and secondary Logic Managers communicate with each other over the UCN and over the Redundancy Data Cable that links the RCMs together. LM status information and the entire database are passed from the primary LM to the secondary LM (or reverse) over the data cable. Switchover between the primary and secondary (lead/backup) RCMs is signalled by the RCMs. A cable links the RCM, LMM, and SLM together, and signals which Control Processor is the lead. In the event of a single LM failure, switchover to the secondary LM causes notification of the operator at the Universal Station.

To assure a high level of system security, only serial I/O is supported with a redundant

configuration. Redundant serial communications are included.

The configuration shown in Figure 7 depicts the use of a Serial Link Selector (SLS), which is a 2-slot module that serves as a general-purpose switching device. In a typical redundant configuration, the SLS is used to switch the 623-60 Loader/Terminal from the primary to the secondary processor card file when switchover occurs.

In accordance with standard practice, UCN connections to both the primary and secondary LMs are redundant.

Special Processor Modules

Several special-function modules are available for insertion into the option slots in the Processor card file. These are listed in a table at the end of this document.

Program Loaders

The **Model 623-60 Loader** is a package designed to run on an MS-DOS-compatible personal computer. It contains a serial interface board, floppy disks, and appropriate manuals.

Other Options

Two types of LM power supplies are available. One is powered from a 24 Vdc source, and the other can accept either 115 Vac or 230 Vac.

The Logic Manager normally includes one or more standard Honeywell UCN cabinets. Optionally, NEMA 12 enclosures can be supplied. Remote mounting of serial I/O card files can also be accommodated.

In addition to the many types of I/O modules, related I/O hardware is available.

This includes card files, power supplies, and I/O simulator assemblies.

The Logic Manager is a powerful and highly flexible product. Although the standard options have been briefly described above, other options to meet special requirements can also be supported. Contact your Honeywell representative for more information.

Specifications

Processor and I/O Card Files

Parameter	Specification
AC Voltage Vac RMS Frequency (Hz)	115/230 ±15% (1) 47-63
Normal Load (watts)	115
Surge Current (amps)	15 for 1 cycle from cold start
Power Fail Level Vac Vac Vdc	115-85 230-190 24-19
Power Fail Delay (ms) 115 Vac 24 Vdc	11.5 7.0
Operating Temperature (°C)	0-60
Storage Temperature (°C) Without Battery With Battery	-40-85 0-60
Relative Humidity (% non-condensing)	5-95
Height (in/cm)	10.7/27.2
Width (in/cm)	19/48.3
Depth (in/cm)	7.5/19.1

Processor Card File

Parameter	Specification
Real I/O Capacity (max. points) Serial I/O Parallel I/O	2040 2048
Data Registers	4096
Register Size (bits)	17 (16 + sign bit)
Ladder Logic Program Memory Size	24 kwords
Timers Maximum Number On/Off delay time Resolution	1024 Up to 65,535 sec. 0.01, 0.1, 1.0 sec.
Counters	Up Down Up/Down
Math (Integer-type)	Add, Subtract, Multiply, Divide, Equality Less than Greater than
Memory Type	Read/Write CMOS
Battery Backup Processor (years minimum) LMM (months minimum)	1.5 6
Battery Processor LMM	Lithium Size D Lithium 2/3 AA
Memory Usage	one word per ladder diagram element
Scan Rate/k of logic (ms) (2) Relay only Nominal Mix Math Intensive	2.5 6.05 8.88

- Notes: (1) 250 Vac maximum (fuse rating)
(2) Based on analysis of actual user programs for machine control

Serial I/O

Parameter	Specification/Description
Data Transfer Medium	Serial 4-wire full duplex (asynchronous to processor scan)
Data Rate	115.2 kbaud
Electrical Format	RS485
Serial Channel Scan Rate	Function of the number of card files per link, the number of card files containing PUSH/PULL cards, and the number of PUSH/PULL cards updated per scan (all or 1 per scan)
Maximum Drops per Channel	16
Maximum I/O per Channel	2040
Maximum Channel Length	4,000 ft. (Belden 9729 with 200 ohm terminating resistor) or 10,000 ft. (Belden 9182 with 300 ohm terminating resistor)
Error Checking	Cyclical redundancy check plus data-receive timeout
Operating Current Serial Link Module, Model 621-9939 Serial I/O Module, Model 621-9940 Serial I/O Module, Model 621-9938R	2.60 A (+5 Vdc typical) 2.03 A (+5 Vdc typical) 2.06 A (+5 Vdc typical)

Module Tables

The following tables show I/O options and special processor file options for the Logic Manager. For the individual I/O module specifications, see the Honeywell Logic Controller *621 I/O Specifications User Manual*.

Digital Input Modules

Description	No. of Inputs	Model Number	IEEE 518 Signal Level Wiring Class
Simulator Input Module	8	621-0009R	N/A
115 Vac/dc	8	621-1100R	DATA 3
115 Vac/dc isolated	6	621-1101R	DATA 3
115 Vac	16	621-1160R	DATA 3
115 Vac	32	621-1180R	DATA 3
230 Vac/dc	8	621-1200R	DATA 3
230 Vac/dc isolated	6	621-1201R	DATA 3
240 Vac	16	621-1250R	DATA 3
240 Vac isolated	16	621-1251R	DATA 3
24 Vac/dc	8	621-1500R	DATA 2
24 Vac/dc	16	621-1550R	DATA 2
5Vdc sink	8	621-3300R	DATA 1
12Vdc sink	16	621-3450R	DATA 1
12-24 Vdc sink	8	621-3500R	DATA 1, 2*
12-24 Vdc sink fast response	8	621-3502R	DATA 1, 2*
24 Vdc sink fast response	16	621-3552R	DATA 2
24 Vdc sink	16	621-3560R	DATA 2
24 Vdc sink	32	621-3580R	DATA 2
48 Vdc sink	8	621-3600R	DATA 2
48 Vdc sink	16	621-3660R	DATA 2
5 Vdc source	8	621-4300R	DATA 1
5 V TTL	16	621-4350R	DATA 1
12-24 Vdc source	8	621-4500R	DATA 1, 2*
12-24 Vdc source fast response	8	621-4502R	DATA 1, 2*
24 Vdc source	16	621-4550R	DATA 2

* The IEEE 518 signal class is application-dependent and can vary with the voltage and current present in the wiring.

Digital Output Modules

Description	No. of Outputs	Model Number	IEEE 518 Signal Level Wiring Class
Reed Relay	6	621-0007R	DATA 1, 2, 3*
115 Vac isolated	8	621-2100R	DATA 3
115 Vac source self-protected	6	621-2101R	DATA 3
115 Vac	8	621-2102R	DATA 3
115 Vac	16	621-2150R	DATA 3
230 Vac	8	621-2200R	DATA 3
230 Vac isolated	6	621-2201R	DATA 3
24 Vac	8	621-2500R	DATA 2
24 Vac	16	621-2550R	DATA 2
5 Vdc source	8	621-6300R	DATA 1
5 V TTL	16	621-6350R	DATA 1
12 Vdc source	16	621-6450R	DATA 1
12-24 Vdc source	8	621-6500R	DATA 1, 2*
12-24 Vdc source self-protected	8	621-6503R	DATA 1, 2*
24 Vdc source	16	621-6550R	DATA 2
24 Vdc low power source	16	621-6551R	DATA 2
24 Vdc source	32	621-6575R	DATA 2
24 Vdc source	8	621-6600R	DATA 2
48 Vdc source	16	621-6650R	DATA 2
120 Vdc source (0.5A)	8	621-6700R	DATA 3
120 Vdc source (2A)	8	621-6701R	DATA 3

* The IEEE 518 signal class is application-dependent and can vary with the voltage and current present in the wiring.

Analog Input Modules

Description	No. of Inputs	Model Number	IEEE 518 Signal Level Wiring Class
Universal (current, voltage, or TC)	16	621-0020R	DATA 1
Isolated (4-20 mA)	8	621-0022-AR	DATA 1
Isolated (0-10 V)	8	621-0022-VR	DATA 1

Analog Output Modules

Description	No. of Outputs	Model Number	IEEE 518 Signal Level Wiring Class
4-20 mA	4	621-0010-AR	DATA 1
0-10 V	4	621-0010-VR	DATA 1

Special Function I/O Modules

Description	Model Number	IEEE 518 Signal Level Wiring Class
BCD Converter	621-0006R	N/A
ASCII Communications	621-0012R	DATA 1
Absolute Encoder	621-0018R	DATA 1
Pulse/Quadrature Input	621-0019R	DATA 1
Pulse Input	621-0024R	DATA 1
Resistance Temperature Detector	621-0025R	DATA 1
High-Speed Counter	621-0307R	DATA 1
24 Vdc sink input, source output	621-0576R	DATA 2
MiniCOP Microcomputer Double-wide, 3-Port	627-1002R	DATA 1
MiniCOP Microcomputer Triple-Wide, 4-Port + RGB output	627-1003R	DATA 1

Special Function LM Processor File Modules

Description	Model Number	Each of these modules requires one option slot in the LM Processor Card File.
8 k Memory Module	620-0027	
Control Network	620-0038	
MODBUS/RTU Computer Interface	620-0043	
ABC Data Collection	620-0048	
ABC Dual Port Data Collection	620-0052	

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