LC700

PROGRAMMABLE CONTROLLER



smar

OVERVIEW

The **LC700** is a powerful Universal Hybrid Controller that can be used as a stand-alone or a full participant of Smar System302. Smar excellence of design was consistently applied to the LC700 to make it reliable and dependable even on the most demanding industrial environments and applications.

Experience

The LC700 is the seventh generation of controllers from Smar, and our experience from a wide range of industries is reflected in this device. Since its introduction it has been successfully field proven in many simple and complex installations in a wide range of industries, e.g., petrochemical, water treatment, pharmaceutical, food industry, sugar mill, power plants, pollution control among others.

As a Universal Hybrid Controller, the LC700 was designed from the beginning with traditional discrete manufacturing automation tasks, continuous regulatory process control and batch control in mind.



Universal Hybrid Controller

As a hybrid controller, it has the logic capability and speed of a traditional PLC, and the regulatory features and power of a DCS. A powerful hardware platform with a wide range of conventional I/O modules and field communications modules for leading industrial networks combined with an extensive set of programming function blocks and logic elements makes the LC700 extremely versatile.

Smar can be a one-stop solution for many different applications. Today, Smar offers a complete line of Controllers, Software, Field Devices and Industrial Networking all integrated for your convenience. Moreover, your purchasing and vendor relations become simplified.

HIGHLIGHTS

- ✓ True Industrial Universal Hybrid Controller
- ✓ Data saved on EEPROM (No more batteries to change)
- ✓ Slim hardware and code for reliability and dependability
- ✓ Fault tolerant for high availability with many levels of redundancy
- ✓ Compact, modular and scaleable
- ✓ Remote I/O for distributed and long distance data transfer
- ✓ Ready for Foundation Fieldbus, Profibus, DeviceNet and Modbus
- ✓ Modbus/TCP and Modbus RTU for control network
- ✓ Ethernet and/or Serial OPC server for HMI clients

SCALABLE

The LC700 modularity makes it flexible enough to reach small and large applications as well as making future expansions a breeze. The LC700 modular architecture is supported on a standard DIN-rail mounted backplane (Rack) into which all Modules are installed.

Smar has a wide range of modules for the LC700 such as; Power Supply, Controller (CPU), Discrete I/O's, Analog I/O's, Special Signals and Network Interface Modules.

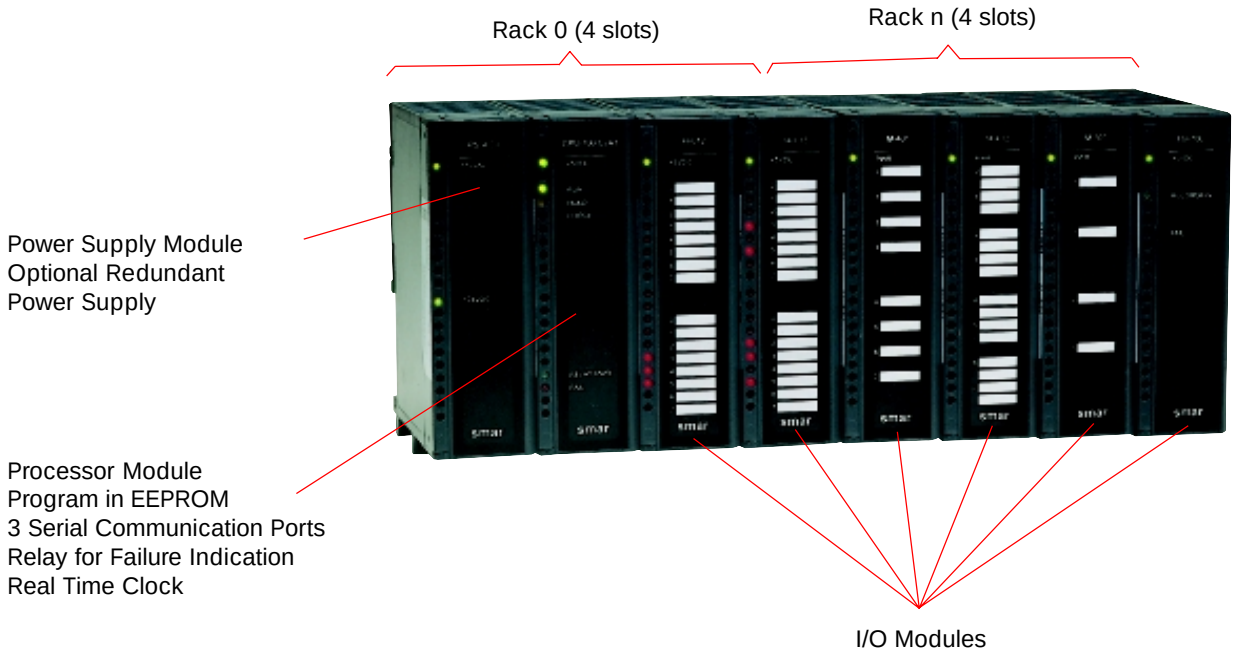
A large Function Block library comes already built-in on the flash memory. Function Blocks can be used as many times as necessary with no licensing scheme as you may find in other vendors. The limit will be the available memory and not a restringing contract to limit your imagination.

The LC700 can operate stand-alone in a single rack configuration, or networked as a large control system. Expanding a LC700 based system is very easy and comes at a minimal cost. Enlarging the system is as easy as adding more I/O modules or connecting additional LC700 controllers. Because it is so compact, any additional cabinet space may not be required.

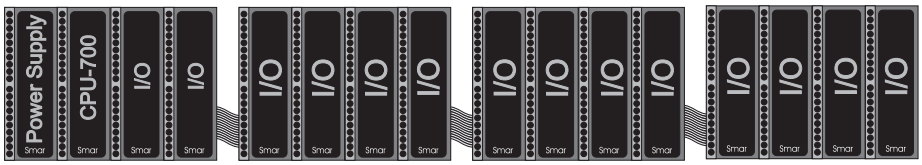
The **LC700** is composed of Racks carrying slots where Modules are mounted. Additional Racks can be added to support the installation of more Modules. Racks are connected between them through the use of Flat-Cables. This type of expansion is called “local expansion”.

Another way to expand the LC700 system is to add remote units in different areas of interest and have them connect with a twisted pair cable to the main Processor. This technique provides great signal distribution, besides wire and installation costs.

Illustration shows a simple LC700 system with local and remote I/O expansion.



Local I/O Expansion



Up to 15 Expansion Racks can be connected to accommodate a large variety of Modules.

Remote I/O makes it possible to distribute racks with I/O modules at various locations in the field and connect them to the CPU via a high-speed RS485 network. Distributing the Racks will save in wiring and installation costs and the signals can still be part of the same configuration.

Remote I/O functionality is also the key to the **LC700** processor (CPU) redundancy as it allows both the main and standby CPU to be connected to the I/O remote system, always enabling the active CPU (the one in control) to access data on the remote I/O system(s). The remote I/O master capability is already built into the CPU, hence no additional remote I/O module is required. The remote I/O subsystems are each fitted with a remote I/O interface module with high-speed redundant communications ports.

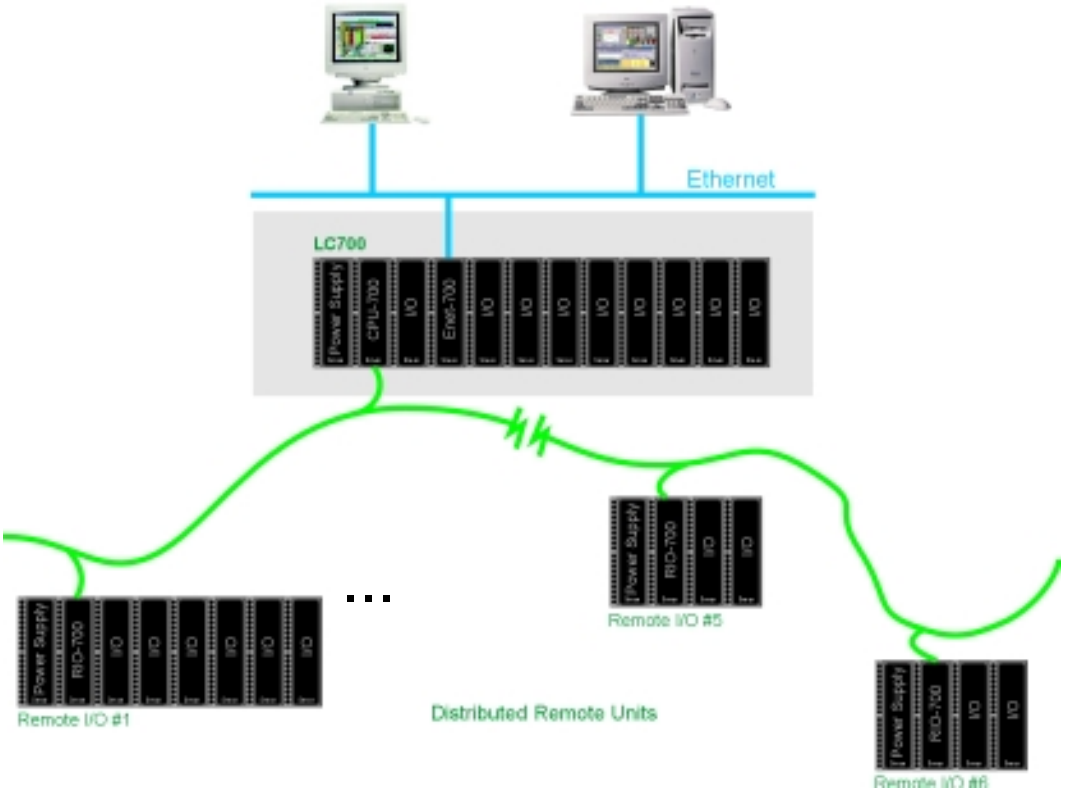
Significant cable savings

Remote I/O drastically reduces wiring and simplifies installation and maintenance work. Remote I/O network communication speed can be configured as high as 460.8 kbit/s while long connecting twisted-pair cable size will depend on the configured speed and line conditions.

As many as six remote-I/O subsystems can be connected to per processor module (CPU) achieving significant cable savings. This reduces discrete wiring by locating I/O subsystems close to the process by eliminating terminal blocks and long wire runs. Remote I/O also increases module capacity. Any conventional I/O or field communications module can be located in the remote I/O racks.

Remote I/O network redundancy

When the application calls for very high availability, the remote I/O networking can also be made redundant providing protection against cable breaks and shorts. In the unlikely event that communication on one of the RS485 networks breaks down, communication between the CPUs and the remote I/O subsystems will be done over the second network allowing control to continue. Thus added security and protection is achieved, no single point of failure can thus disable the control system.



Remote I/O capability to improve distribution and installation savings.

Unexpected control interruptions can be both costly and dangerous. Therefore the **LC700** has been designed to ensure multiple layers of redundancy and enable you to build a system fault tolerant from the ground up providing uninterrupted control.

Two identical LC700 racks with power supply and controller modules may be connected in parallel to provide redundant power and control. A key to the fault tolerance is that the main and standby sets are physically separated to eliminate common causes. Because they are on different racks, they will not necessarily be subjected to the same operation hazards, such as conducted noise, propagated interference or even situations of common damaged signal lines. Internal diagnostics ensures that in case of failure on the main processor the standby will gracefully resume the control and alert operation.

Top level features for the redundant system

Control switchover is synchronized and fast.
A faulty unit can be replaced without stopping the process.
Replacement of a faulty processor (main or standby) does not demand pre-configuration.
A modification sent to the main processor is automatically passed to the standby processor.

Redundancy on all levels for high system integrity

The LC700 makes possible redundancy at every level:

LC700 System:

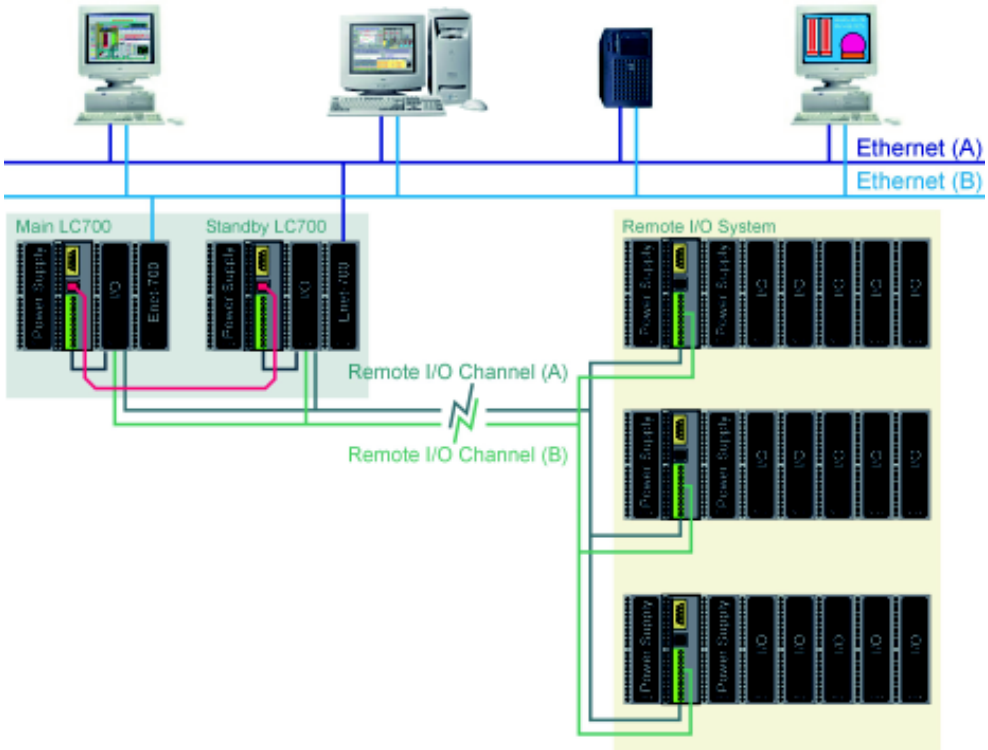
- Redundant power supplies with dedicated relay for failure indication
- Redundant processors (CPU) with dedicated relay for failure indication
- Redundant racks
- Redundant remote I/O communications ports

Control network level:

- Redundant Ethernet wiring
- Redundant Serial Port access
- Single node per segment
- Redundant network hub/switch
- Redundant hub/switch power supply

Workstation Level:

- Multiple operator workstations
- Dual workstation network cards
- Multiple hard disks
- UPS power
- Redundant OPC server



Redundant system with double Ethernet (hubs/switches are not shown), double Remote I/O lines and double Power Supplies on every Remote I/O system.

As shown above, the **LC700** has a wide variety of redundancies available making it possible to tailor the most cost effective solution for each particular need. You can relax secure in the knowledge that the LC700 is very fault tolerant, providing a good degree of safety and also a high availability ensuring minimum losses due to process downtime. Virtually impervious, you can enjoy safe reliable control at all times. Because of the extensive self-diagnostics in every part of the system, the operators are notified in case of any device or communication failure.

Industrial Strength

Mission critical control applications require a high level of safety and availability that cannot be met by soft logic in a PC for or a PC in a black box. PC processors and desktop-derived operating systems are designed for desktop application tasks far less critical with an emphasis on graphics and with less stringent response requirement than control. These may need to be manually “rebooted” after a power loss or “lockup”. Such architecture is not suitable for the control level of a plant. The LC700 is instead based on a powerful embedded processor and a stable embedded industrial grade real-time multitasking operating system designed for critical applications and uninterrupted operation. True real-time performance ensures timely control. This platform also requires less memory, therefore making it even more reliable. The LC700 has no moving parts such as fans or hard disks. The program runs in RAM memory that is mirrored to an EEPROM on the same memory chip. In the event of a power failure the RAM data is immediately copied to the EEPROM which retains the data for several years without any battery. This also enables retentive memory coils, where the last output value before power failure is remembered, and the controller automatically reverts to this last value when power is reapplied. Likewise, integrated values such as flow or energy totals are also retained during power losses.

Easy Maintenance and Operation

The LC700 has built in self-diagnostics and also includes a diagnostic status block. Device status is communicated and displayed at the operator workstation. CPU failure is also indicated locally by a clear LED and a relay output suitable for separate interlocks. Because the LC700 has no battery, there are no parts that need replacing, reducing maintenance work. Remote ID and check simplify commissioning. Clear LED’s indicate if inputs or outputs are forced or locked and active communication on the Remote I/O network.

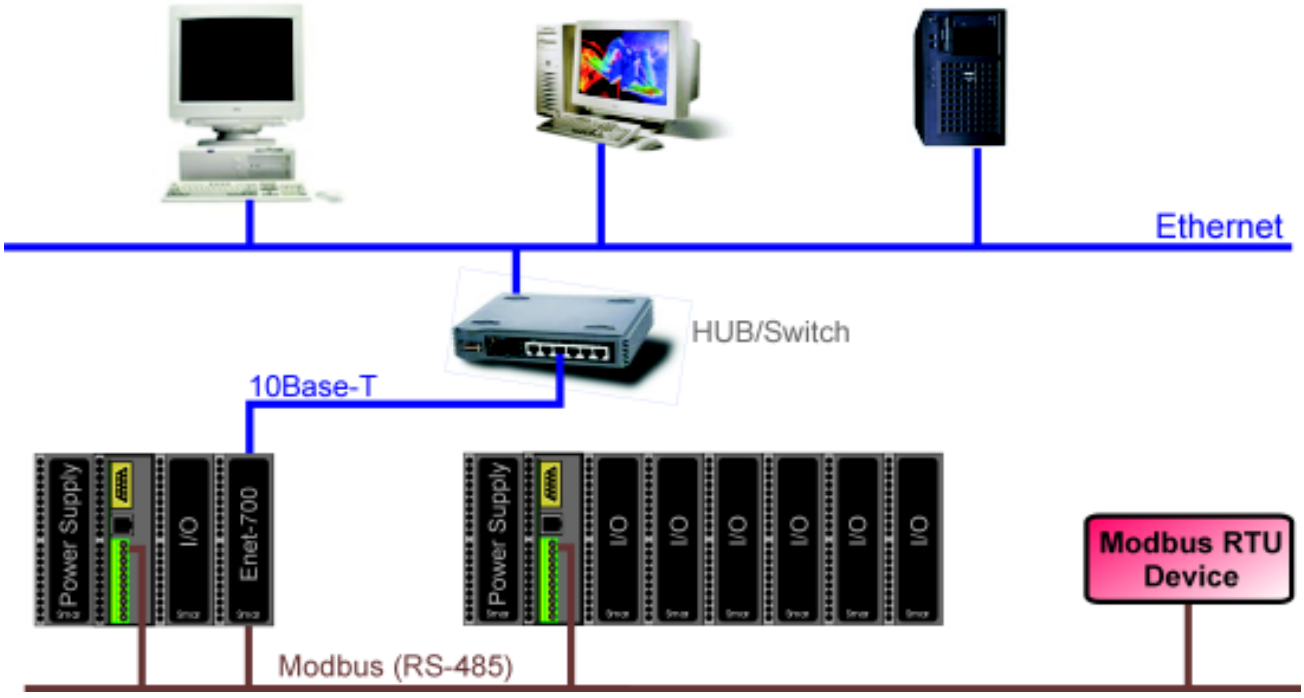
The **LC700** uses the widely accepted and well-understood industry standard Modbus protocol as a control network. Several options are supported. You can use Modbus/RTU with RS485 wiring communicating at speed as high as 115.2 kbit/s for long distances in industrial environments or Modbus/TCP using Ethernet wiring at a speed as high as 10 Mbit/s. A direct RS232 for short local connection is also possible, ideal for a portable computer or a local operator panel, e.g., for maintenance. The Modbus network is used as a control level network passing process variables and modes to the operator workstations as well as configurations and diagnostics to the engineering stations. The Modbus protocol has a fair amount of interoperability and enables the LC700 to replace other Modbus controllers and integrate to existing control systems.

The simplicity of Modbus makes it easy to use and most engineers are already familiar with it. Other Modbus device types can be connected on the same network as the LC700 in multi-drop architecture, simplifying the networks.

Modbus/RTU

Several LC700's may be multi-dropped on the same RS485 network with a simple twisted-pair wiring. This makes very large and distributed systems possible. The LC700 may also coexist with other Modbus devices on the same network. The maximum network size depends on the selected speed and the prevailing line conditions and environment.

The Modbus/RTU protocol limits a network to a single master, but the LC700 CPU module has three independent communication ports making it possible to connect three masters at the same time, e.g., to get redundant workstations and communication networks.



Two LC700 and generic Modbus device are sharing the same ENET-700 module.

Ethernet Modbus/TCP

Using the Enet-700 module the **LC700** can be connected to an Ethernet 10base-T. Now more than one computer in the Ethernet network can communicate with the LC700 using Modbus/TCP advanced industrial protocol.

This network may be either simple or redundant and operates at 10 Mbps on shielded twisted pair cabling, much faster than traditional control system networks. The Enet-700 module connects one or more LC700 processor (CPU) modules and even non-Smar standard Modbus devices. In this way several LC700 may be connected to the same Ethernet Fieldbus making very large systems possible. The LC700 may also coexist with other Ethernet devices on the same network. Wiring of LC700 nodes and workstation nodes are physically arranged in a star topology with Enet-700 module per Ethernet segment using hubs or switches. This topology ensures that a problem with one node or segment does not affect the communication with other nodes.

An important aspect of the Modbus/TCP protocol is that it provides interoperability above and beyond the functionality of Ethernet and TCP/IP. Many systems based on Ethernet claim to be open while they in fact are not because their application layer protocol is proprietary, making it impossible to access their information through the network. Modbus/TCP overcomes this problem.

Control network redundancy for safety and availability

For critical applications the control level network may be redundant. This is possible with RS485 Modbus/RTU as well as Modbus/TCP on Ethernet. Because the two RS485 ports operate independently and simultaneously, the controller can be connected to the workstations via two redundant networks.

For redundant Ethernet Fieldbus the wiring is simply duplicated. All Ethernet devices including the workstations are connected to both Ethernet buses. The Ethernet hubs are also duplicated. Each of the redundant LC700 CPUs works in conjunction with its own Enet-700 module. The LC700 and workstations continuously monitor both the Ethernet Fieldbus networks. Should either one of them fail, it will inform the user and use only the good network. The switchover is totally bumpless and transparent to the rest of the system. Therefore process upsets are avoided, and control continues as usual. LED's indicate which of the Ethernet networks are operational or have failed. Smar can provide commercial or industrial grade hubs for twisted-pairs or fiber-optics. Industrial grade hubs are DIN rail mounted and have redundant power supply.

Two redundant OPC servers on separate computers poll the two networks. Only one OPC server is active at any one time, switchover is handled by the OPC client application.

Fiber Optics

For long distance transmission, to avoid ground loops and electrical noise we may consider the use of fiber optic between areas. Fiber optic is ideal for networking between buildings and on very noisy environments. With the use of converter we can connect the Ethernet network to a fiber optic 10Base-FL. Now we can reach distances of 2 km or add line repeaters to be able to go further.

Radio

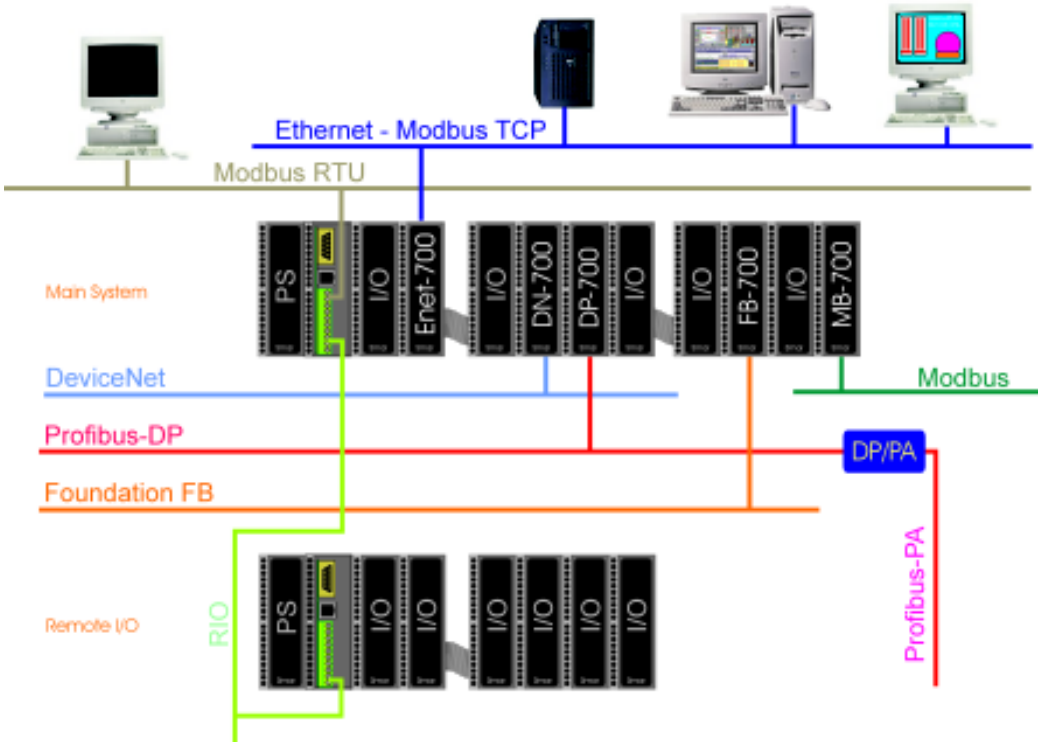
For process monitoring and configuration over very long distances, such as for SCADA and telemetry applications for pipeline and wellhead monitoring, Smar can supply a standard radio modem system for networking. One or more LC700 operating like RTUs can be linked to a central monitoring location. The radio modem link is totally transparent and no modification is required to the LC700, nor the OPC server. A wide range of antennas, radios and repeaters are available to cover many applications and local regulations.

Smar's expertise in communication is reflected in the wide range of field communications modules available for the **LC700**. In addition to the conventional I/O modules the growing range of communication interface modules allows the LC700 to connect to networks using several popular industrial protocols. Thus the LC700 can be adapted to many different architectures to be integrated with new or existing systems.

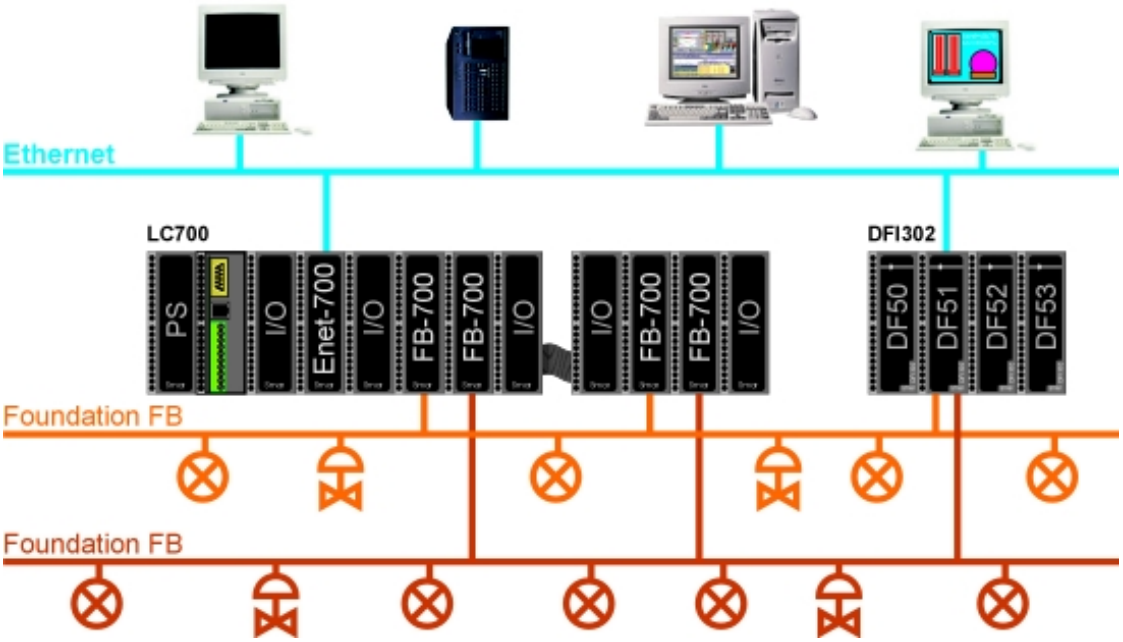
The communication interface modules can be mixed and matched freely to suit the application. Field connectivity can be reached with a large variety of I/O modules connected directly to the sensor and also interfacing with devices communicating through popular protocols as: Foundation Fieldbus, Profibus DP and PA, DeviceNet and Modbus. Remote LC700 I/O modules can also be distributed in the plant using the remote I/O interface module.

Foundation Fieldbus

The FB-700 interface module connects the LC700 to an H1 Fieldbus network. The FB-700 module is Foundation Fieldbus compliant, and includes a wide range of Fieldbus function blocks that can be used as part of the control strategy. The FB-700 (Foundation Fieldbus Module) and all the other devices on the H1 Fieldbus network are configured using the Smar SYSCON application tool. The configuration can be downloaded to the H1 network through the DFI302.



True open phislosophy, support for many industrial networks.



LC700 and DFI are sharing the Ethernet line (hub/switch are not showing). A FOUNDATION Fieldbus configuration can be sent to any of the Fieldbus networks from the PC. The configuration from the PC will pass through the DFI and reach the field devices.

FOUNDATION Fieldbus and Modbus gateway

Fieldbus instruments may be connected to the **LC700** just like any other form of I/O. It also allows the LC700 to act as a gateway between Fieldbus and Modbus allowing legacy system access Fieldbus devices. A LC700 may be connected on the Fieldbus like any other device to handle discrete controls and interlocks. PS302 power supply modules and PSI302 Fieldbus power supply impedance modules can also be fitted to the LC700 to provide the power for the Fieldbus devices.

DeviceNet

DN-700 DeviceNet High Performance Master Scanner adds the capability of integrating DeviceNet slave devices as I/O to the LC700. DeviceNet is widely used among devices common to discrete factory automation.

Profibus

The DP-700 Profibus High Performance Master Scanner uses the Profibus-DP protocol that lets the LC700 communicate with Profibus-DP and Profibus-PA.

In the case of Profibus-PA, third party couplers or linking devices need to be installed in the line.

Profibus-DP is widely used among devices common in discrete factory automation and includes variable speed drives. Smar also carries a broad range of advanced Profibus-PA field devices.

Modbus

The MB-700 Modbus Scanner adds master capability to the LC700 system. This scanner can gather and send data to a standard Modbus slave devices in the field.

A wide range of legacy equipment common in existing plants using the ubiquitous Modbus protocol can thus be accessed by the LC700. The data retrieved can be displayed to the operators and used as part of the control strategy.

The **LC700** interfaces to sensors and actuators in the field through discrete and analog I/O modules on a local extended backplane or as remote I/O. The LC700 I/O may be installed close to the sensors and actuators, thereby eliminating long wire runs and associated panels and cable trays for the conventional I/O, with subsequent savings further reducing overall system cost.

Flexible and scaleable

Since the I/O modules provide modularity, you need not worry about future expansion and spare capacity now. Just buy what you require for your current application. The modularity gives you the flexibility to mix and match the right quantity for each I/O type that you need. As your demand increases or changes, additional backplane segments can be added and modules can be plugged in to the system. Each controller module can be fitted with an I/O-subsystem for up to 1024 discrete points and approximately 1024 analog points Since several LC700 can be networked together in a system, a very large amount of I/O can be achieve.

The I/O modules are multiple-channel high-density. They are typically packaged with as many as 16 channels per module. The LC700 therefore only requires half the panel space compared to a device with only eight channels per module.

All I/O modules are galvanicaly isolated from the rest of the LC700. All I/O circuits are designed so that accidental normal-mode connection of 1000 VAC/DC to discrete I/O field terminals for an unlimited time does not destroy any devices in an I/O group other than the circuit to which the voltage was applied.

I/O modules are available of the following basic types:

Basic I/O Types
Discrete input - DC
Discrete input - AC
Discrete output - Transistor
Discrete output - Relay
Discrete output - Triac
Analog input
Temperature input
Pulse input

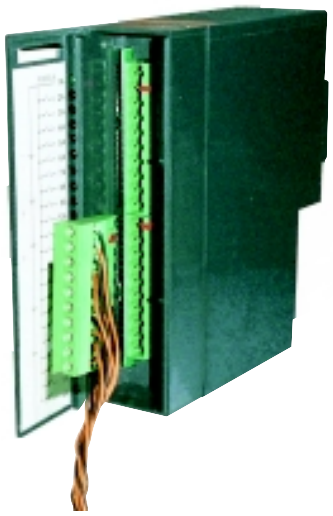
High end modules

Some of the modules have a great flexibility and a sophisticated degree of configuration. For example, temperature module type accepts RTD's and thermocouples, as well as direct resistance and low voltage input ideal for, e.g., load cells. Besides every channel can have an independent configuration regarding type of sensor, operating range and filtering.

Field wiring

External field wiring has multiple point plug-in type connectors so that I/O modules are capable of being inserted into or removed from their backplane without unscrewing external wires. It also allows all the wiring to be made before I/O-module installation. Field I/O wiring is screwed on to the connectors. The connectors have an optional keying which may be set in advance preventing the wrong wire from going into the wrong module. You will always connect correctly, eliminating the risk of applying high voltage to a low voltage terminal. Module damage protection is not enough. If sensors or actuator wiring are mixed up, the plant can go haywire. Keying on the LC700 can be made unique for each and every connector (not just module type) ensuring a correct match and safe operation. Thereby, ensuring that only the intended sensor goes to its assigned module channel. A type number and serial number uniquely identify each type of module.

In addition, each Module clearly indicates the designated field signal range and type. Quick-reference charts are permanently attached to the inside of the modules' front door. The charts clarify proper module wiring. On-line replacement of any module is possible without having to re-configure system software, alter system wiring or cabling, or re-initialize. Modules can be inserted under power and be configured from the CONF700 tool.



Unique keying for each connector prevents mistakes.

All I/O modules have an LED to indicate that it is powered. Discrete modules also have clearly visible local LED status indicators to monitor the status of each input and output. Adjacent to each LED status indicator there is a field where a point description can be written. This is far friendlier than modules where there are no user labels, or the labels are not adjacent to the LED's.

The **LC700** was designed from the beginning with traditional discrete manufacturing automation tasks, continuous regulatory process control, and batch control tasks in mind. The high performance CPU therefore has an extensive set of ladder elements and function blocks enabling it to be used in a wide range of applications, e.g., boiler control and burner management. This allows the user to build the control strategies required for optimal control. Built-in real time clock lets you build control strategies that take date and time of day into account.

The configuration is stored in a non-volatile memory that requires no battery or maintenance.

User Friendly

The selected controller mode (run or hold) is clearly indicated on the front of the controller by individual LEDs and can be set from the engineering tool on-line. The controller module continuously monitors its own status and indicates power and failure via color-coded LED status indicators on each controller faceplate. A relay contact on the module also change status at failure. This may be used as an additional alert to the user, and as part of safety interlocks. Status indication include FAIL (the controller has failed), HOLD (application program execution has been paused), RUN (normal operation) and FORCE (any I/O which is forced or frozen) etc.

Controller Redundancy

The LC700 controller redundancy is much more than just CPU module redundancy. In fact, backplane and power supplies are also made redundant. I.e., totally separate backplanes, CPU's and power supplies to completely eliminate common causes. Many CPU redundancy solutions in the market have many weak points; e.g., the two CPUs may be sharing the same backplane, which if damaged will render both CPUs useless. In the case of the LC700, the main and standby controllers have no parts in common, and can even be mounted in separate panels to avoid common environmental stress. Failure of a backplane only affects one CPU. Fierce EMI/RFI in one location only affects one CPU, the same goes for surges and leaks and other non-predictable occurrences in harsh environments.

This design gives the LC700 an exceptionally high availability ideal for processes that must run continuously for long periods of time without interruption, the process is not affected by a CPU failure. Hours and days of potentially lost production can be avoided, with corresponding savings. A minimum of additional hardware required for redundancy pays for itself in no time.

The LC700 redundancy is a hot standby scheme where one CPU is active while the other is passive. The passive controller is continuously monitoring the health of the active CPU via a secure inter-CPU connection assuring a very fast switchover. In the event of a main controller failure the passive CPU becomes active and takes over all functions with no significant bump to the plant. The two CPUs change information over the high-speed inter-CPU connection at every cycle, enabling the backup to smoothly take over using up-to-date information and therefore a minimum impact on the process. The inter-CPU communication keeps all time-related functions in lock step: PID controller integration, timers, counters, real time clock and totalizers. The inter-CPU communication is transparent to the user, no special configuration is required.

The redundancy capability is built into the CPU modules; therefore any additional modules for remote I/O or inter-CPU communication are not required. Nor is any central redundancy manager device required. Therefore lots of precious panel space is saved, and hardware costs reduced.

Network switch over

The redundancy automatically manages the Modbus network address of the CPUs, upon control transfer the backup CPU takes over the address of the failed CPU as it switches from passive to active. This is done totally transparently to the user and all communication nodes and software; hence no special configuration of any kind is required in the host computers. I.e., the redundancy is extremely simple to set up.

Indication and announcement

LED's indicate which controller is active and which is passive, or perhaps failed. Workstations monitor the status of both CPUs via the communication and immediately notify the user of any faults to the active or passive CPU. Additionally, the CPU has a failure relay output ideal for connection to independent shutdown logic. When a new configuration is downloaded to the active CPU, it is automatically copied to the passive controller via the inter-CPU link ensuring that it is ready to take over the control task in case of failure. The configuration integrity is always checked at power-up and while running the active and passive CPUs are compared. In case of mismatch the active CPU configuration is copied to the passive CPU. This, e.g., ensures that a newly replaced CPU module is updated with the existing configuration. It does not need to be pre-configured before installation.

Because this task is automatic, there is no risk of switchover failures due to incompatible configurations.

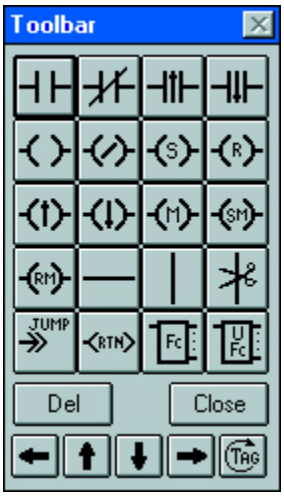
Power Supply Redundancy

The power supply redundancy in the LC700 is two tiered, and can be made quadruple if you like. The most common solution is two redundant CPUs in individual backplanes have just one power supply module each, i.e., dual redundant power. Another option is to have a single CPU powered by two redundant power supply modules, typically connected to different sources. For maximum system integrity, two redundant CPUs in individual backplanes with two redundant power supplies each, i.e., quadruple power redundancy. This way the system is able to handle CPU failures and multiple power supply failures.

IEC 61131-3 Ladder Diagram with Function Blocks

The LC700 control strategy and user application program is built using the standard IEC 61131-3 ladder diagram language (a.k.a. relay ladder logic). This is the most widely used language for logic since it is completely graphical, ideal for, e.g., machinery control. Proprietary programming languages are a thing of the past. Many function blocks are tailored for process control tasks and are already built-in in the flash memory of the processor module. Following are tables commenting on the logic and function blocks that are ready for the Ladder Logic configuration.

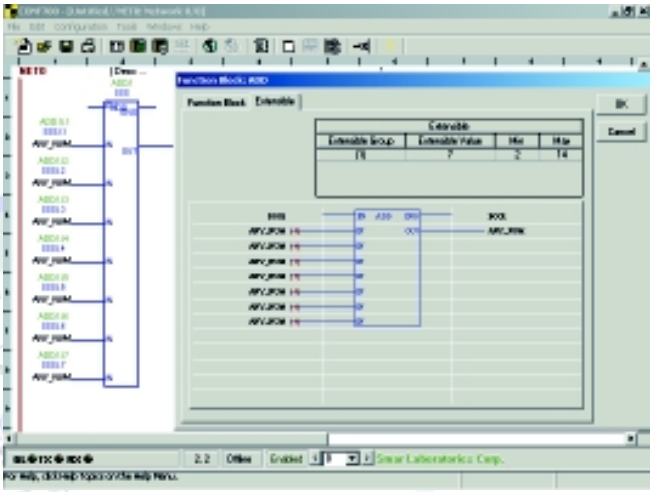
Category	Element
Contacts (input)	Normally open contact Normally closed contact Positive transition contact Negative transition contact
Coils (output)	Coil Negated coil Set (latch) coil Reset (unlatch) coil Retentive (memory) coil Set retentive coil Reset retentive coil Positive transition coil Negative transition coil



Category	Function Block
Numerical functions	Absolute Square root Constants
Selection functions	Selection Maximum Minimum Limiter Multiplexer
Arithmetic functions	Add Multiply Subtract Divide Module
Comparison functions	Larger Larger or equal Equal Smaller or equal Smaller Not equal
Counter Function Blocks	Up counter Down counter
Timer Function Blocks	Pulse On-delay Off-delay Real-time-clock
Process Control Function Blocks	Cross Limit and Rate-of-Change limit Totalization Sample and hold with up/down ramping Setpoint Ramp Generator Linearization PID control Step control Data logger Pulse counter Flow compensation, Lead-Lag, Scale, ...

Extensible number of inputs

Many of the function block types are extensible, meaning that they don't have a fixed number of inputs, but instead the user can select as many inputs as required to perform the task. This reduced the number of blocks and links required, making configuration easier and faster. The control strategy can be divided into smaller individual network diagrams, each one doing part of the task. The execution order can be configured, and jumps can be done between subroutines based on conditions. User defined function blocks may be created in a structured text like language and then inserted as part of the configuration. These are ideal for complex logic and manipulation. A library of pre-configured templates for common control strategies and logic is available. Additionally, templates can also be user-defined. Templates make configuration fast, neat and error free. CONF700 thus makes you very productive.

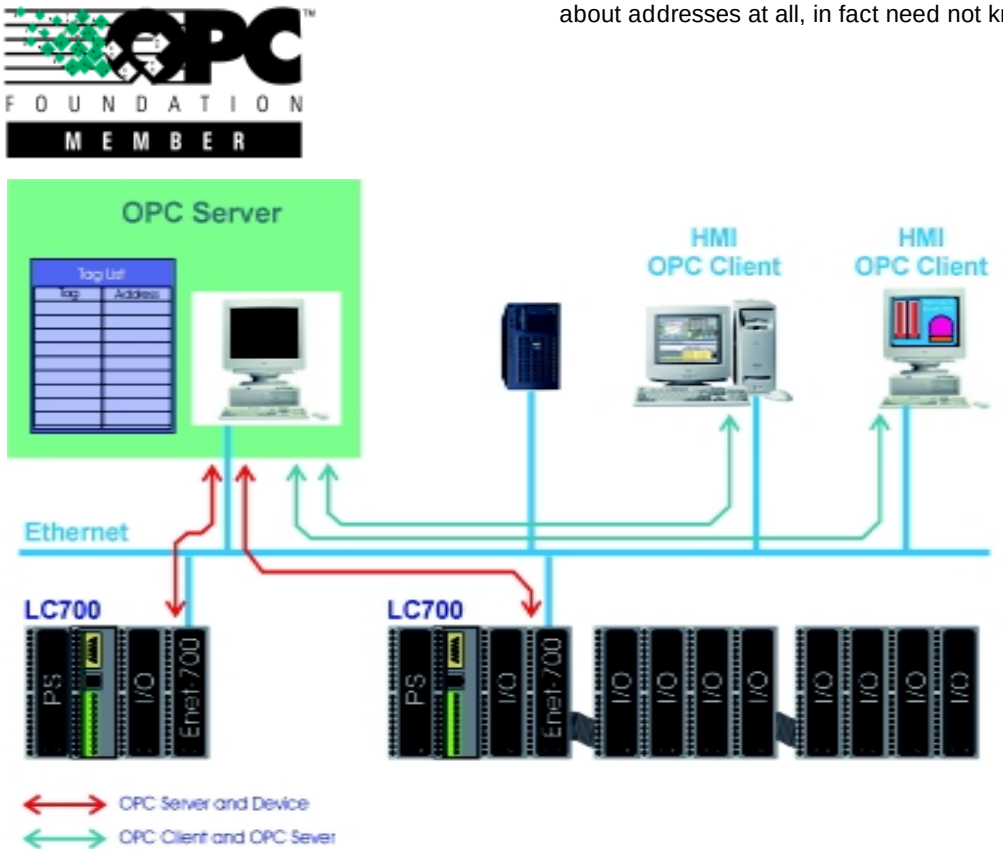


Function Blocks it configurable number of inputs.

OPC CLIENT / SERVER ARCHITECTURE

In the control room the operators view process variables and initiate control actions from the operator workstations. A tightly integrated system is easily achieved because the **LC700** comes with an OPC server that makes all the data in the LC700 in the system available to any OPC compliant software. The server accesses the LC700 through the serial port or on the Ethernet network and makes the information available to other workstations. Tags entered in the configuration tools are shared throughout the system, hence there is no need to map, patch or rename variables. Once a tag is configured, it never has to be entered again.

OPC is a widely accepted industry standard client-server technology for interchanging parameter values between applications. Multiple clients can simultaneously access the server located in the same workstation or remotely over the Ethernet. This enables a single distributed Fieldbus database to be shared among workstations, eliminating inconsistencies. After the configurations for all the LC700s in the system has been created, all the tags and their corresponding CPU addresses and Modbus registers are exported as a tag list to the Modbus OPC server. The OPC server can therefore provide all the LC700 parameters based on their tag. Thus the system becomes completely transparent, the user need not worry about addresses at all, in fact need not know they exist.



Data collected by the OPC server is available for any OPC client in the network.

Single integrated system database

An OPC server feature called “address space browsing” gives the system a single integrated database even if software from several third party suppliers is used. Once a tag has been created in CONF700, it becomes available for access by all other client applications. From the client application you can browse or navigate by pointing and clicking through a Windows explorer like hierarchy until you reach the parameter. You don’t have to retype any tags, eliminating problems due to typographical errors. Since OPC is completely tag based, you don’t have to deal with mapping of device addresses, memory registers and bits and bytes etc. as was common with old PLC and HMI combinations. OPC instead gives an unprecedented level of integration and ease of use, yet complete openness and security.

Data security

Based on multithread programming technology, provided by Windows NT and Windows 2000, the OPC server was developed using a synchronization technique that will only allow one application at a time to modify the database.

Single database

OPC technology seamlessly integrate software applications into a homogenous environment where data is shared throughout the system and throughout the enterprise with the same name as a single database, eliminating inconsistencies and many errors.

The graphical system configuration and maintenance software CONF700 makes configuration entry, management, documentation and troubleshooting very easy.

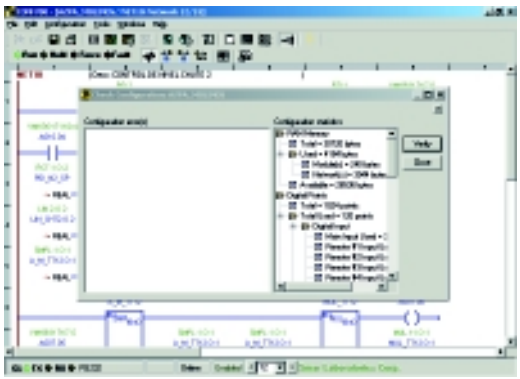
Easy to use

CONF700 is completely graphical and therefore very easy to use, and runs under Windows 9x, NT and 2000. Because it uses standard Windows functions like menus and point and click, it is also intuitive to use. The software is built entirely around the standard IEC 61131-3. Ladder diagram is a popular language for logic, easy to visualize the logic. On-line troubleshooting becomes simple, as it is easy to see which part of the logic which is active and which is not. CONF700 only enables and allows valid entries, and checks for omissions and validates the configuration before download to ensure that it is trouble free and that it matches the CPU version. You can check the configuration any time by a clicking of a button. Debug before you run. Cuts, copy, paste and move functions make it easy to edit the configuration. A search function makes it easy to find blocks and elements by task. CONF700 can also upload an existing configuration from a **LC700**. You can view the executing control strategy real-time; force points to simulate I/O, and even edit the configuration on-line. This makes troubleshooting, debugging and optimization very easy. It is easy to compare to ladder diagrams from different sections of the program.



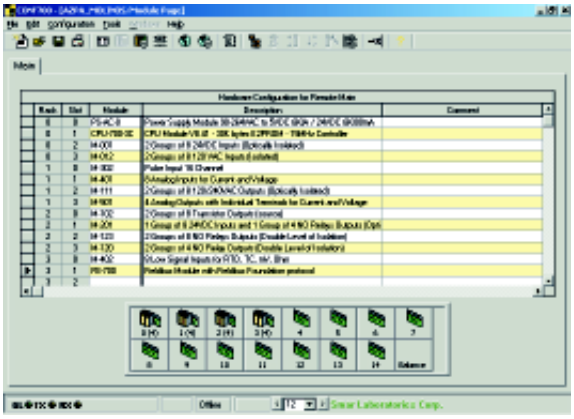
On-line.

Off-line configuration mode makes it possible to start building the control strategy immediately, and configure the LC700 long before the hardware has been delivered. CONF700 calculates the execution time, analogue and discrete point count even when you configure off-line. The memory requirement for the configuration is calculated and verifies it against the CPU resources before download.

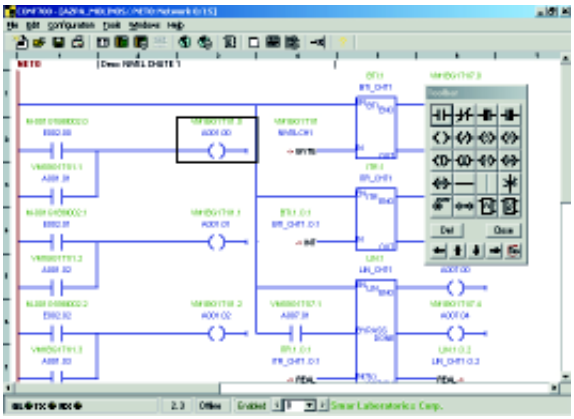


Check Configuration.

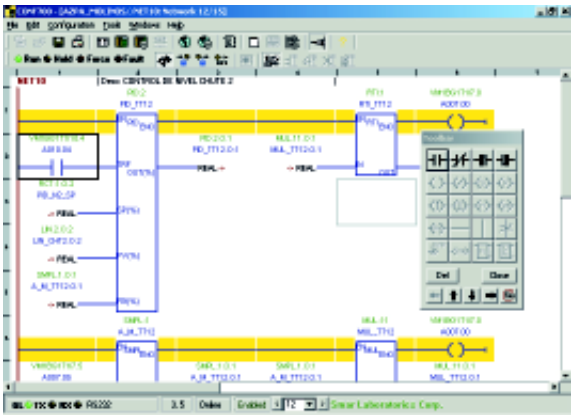
Built in on-line manual makes it possible for you to fully benefit from the software and hardware. I/O module specification and wiring diagrams as well as function block descriptions are included. There is no need to flip pages to look up information on installation and configuration.



Hardware Configuration.



Ladder Network.



Optimization.

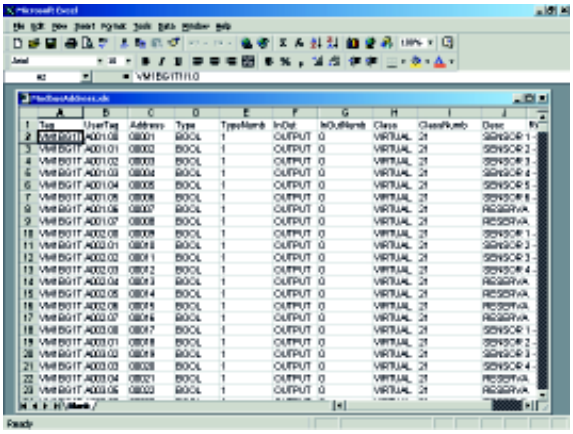
Documentation

The documentation process is traditionally a very time consuming task in project engineering. To manually document the work, or do it in a third party software, is too time consuming and costly, and is error prone. Therefore the CONF700 software has full documentation capability built-in, allowing you to document as you are configuring. All the documentation features are user friendly and extremely easy to use - just fill in the blanks. A large part of the documentation is generated automatically. These powerful features make it easier to manage your configurations, and is the most productive way of documenting your work. Documentation include general project information, hardware configuration, wiring, I/O, control strategy, parameters etc. The user can also enter descriptors and annotations. The configuration can be printed or transferred as an MS-Access database. New programmers can understand configurations made by others.



Integrates with Windows and MS-Office

Because the CONF700 is designed to work on the standard Windows operating system, it benefits from the latest information technology integrating with the common MS-Office suite. CONF700 has an automatic Modbus register cross reference listing which can be exported to an MS-Access file at the click of a button which is useful if you have to configure any software application that does not support OPC to communicate with the **LC700**. This flexibility and openness makes the data available to other applications. In Excel you can easily sort and filter the information to get just the part you are interested in.

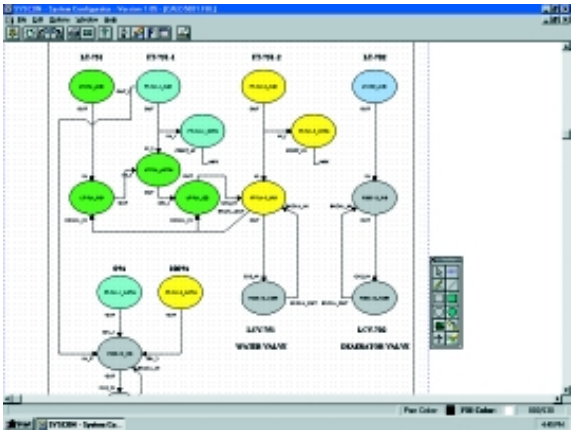


Modbus register listing converted to MS-Excel.

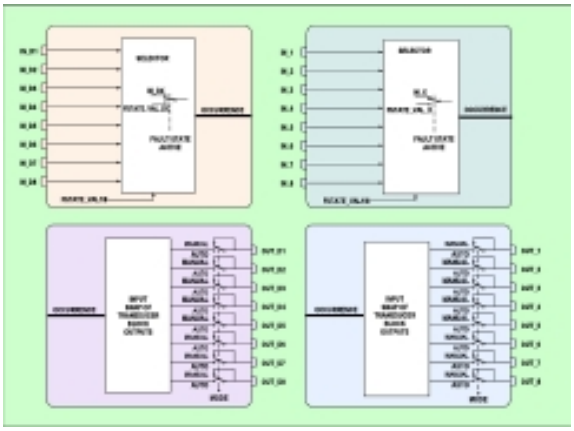
The SYSCON is a powerful and user friendly software tool to configure, maintain and operate a Fieldbus based system through a Personal Computer.

The **FB-700** Module allows the LC700 to interact with Fieldbus Devices in both directions. The FB-700 fits in the network as any regular Fieldbus device.

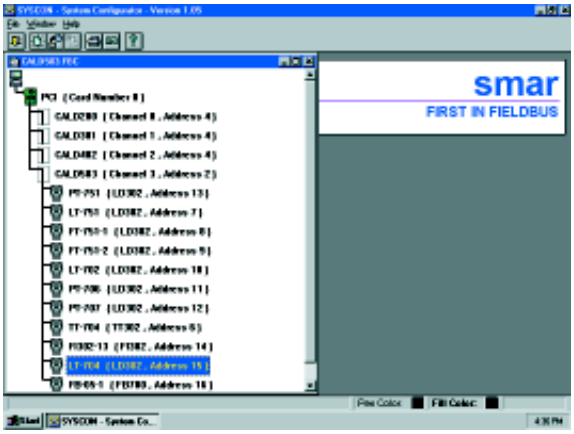
It can share its Functions Blocks with any other connected device after configured by the SYSCON.



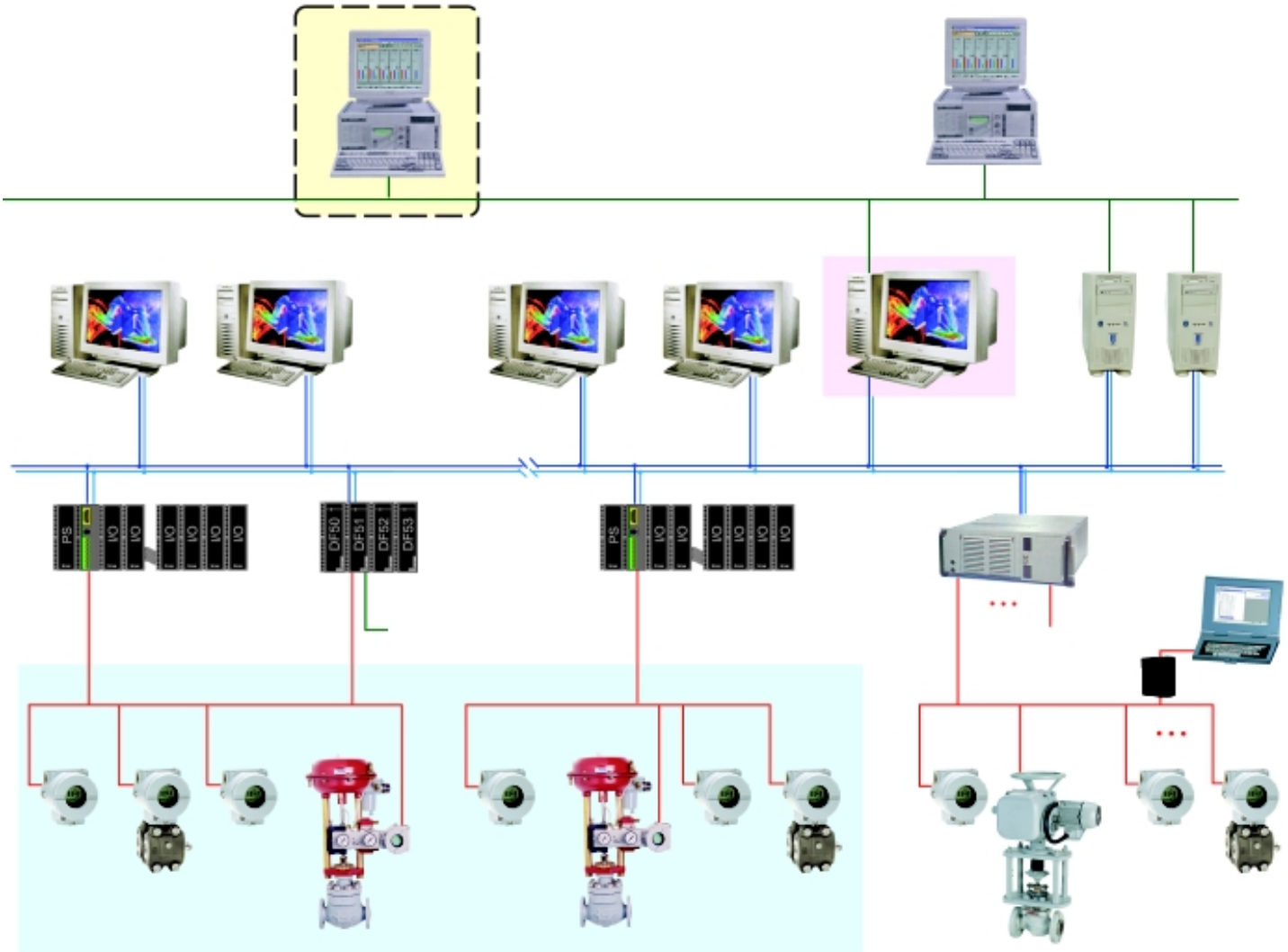
Syscon.



FB-700 Function Blocks for I/O.



Syscon.


PS
IO
DF50
DF51
DF52
DF53



Function Blocks

Function Blocks are easily integrated in the Ladder Logic by the CONF700 programming software.

In this way the user can share the benefits of the discrete logic together with powerful function blocks that he selects from a built-in library.

The **LC700** carries a variety of function blocks to improve discrete and continuous signal type of applications.

Smar used its vast experience in continuous control to add a collection of function blocks dedicated for process control.

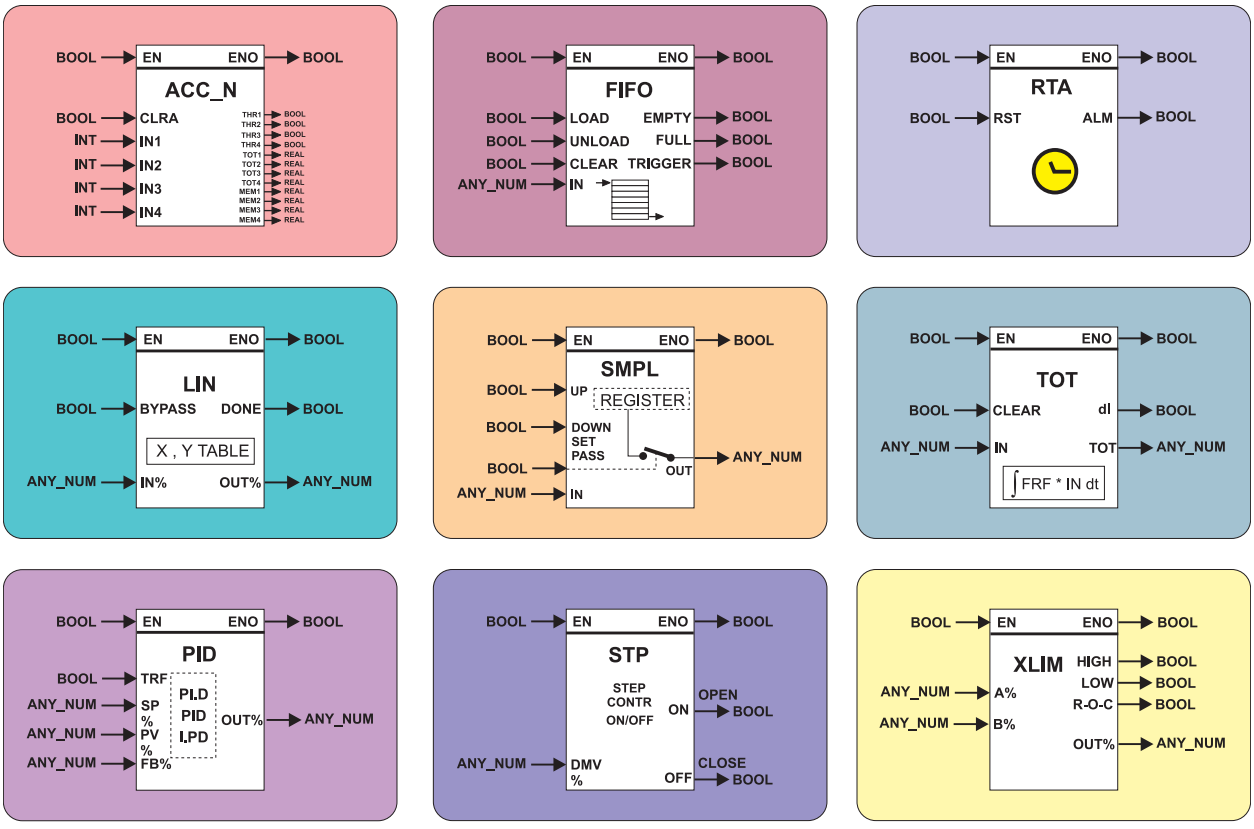
The open architecture of FIELDBUS and the flexibility offered by the PCI (Process Control Interface) enables easy and fast development of drivers for the most popular supervisory software available on the market.

Aimax, Fix, In-Touch, Factory Link, Genesis, Wizcon, Unisoft, Tech 2000 among others are software packages that have or are developing a driver for the PCI and can be easily used to design the ideal man machine interface for your process.

SMAR devices are completed integrated with Aimax for WindowsTM. It contains the all types of drivers to interact with Smar products including the ones for the Smar Fieldbus Family.

Aimax basic characteristics are:

- AutoCAD Like Display Builder
- Multiple Monitor Support
- Real Time / Historical Trend
- Alarm/Action - Status Reporting
- Batch Control
- DDE Server-Client
- Multimedia



Some of Process Control Function Block.



General Specifications

Item	Specification
Power Voltage	90-264 Vac (45-65Hz) / 20-30 Vdc
Consumption	35 VA (Maximum load with one Power Supply)
Operating Temperature	0 °C to 60 °C (32 °F to 140 °F) or 0°C to 50°C (32 °F to 122 °F) see Module Specification
Cooling Method	Air Convection
Storage Temperature	-20 °C to 80°C (-4 °F to 176 °F)
Ambient Humidity	20 to 90% (no condensing)
Vibration Immunity	5 Hz to 2 Khz, 0.4 mm pp/2.5 g panel mounted, 1 hr per axis
Shock Immunity	10 g, 2 Times
Noise Immunity	1.000 Vpp, 1 us
Ambient Atmosphere	No corrossive gases or dust accumulation



Functional Specifications

Item	Specification
True Hybrid Universal Controller	Discrete and Analog Signal Operation 1024 Discrete Points 1024 Analog Points Complete set of logic elements Function Blocks for Process Control; PID, PID Step, A/M, Setpoint Generator, Linearization, Cross Limits, ...
Redundancy	Hot standby redundancy for Power Supply, Controller, Rack, Control Network, Remote I/O Network and OPC server
IEC-61131-3	Ladder Logic with Function Blocks (LD & FB) Click and write Boolean equations with Structured Text (ST)
Control Network	Ethernet (Modbus TCP) or Serial Modbus RTU
Field Network	Remote I/O Foundation Fieldbus Profibus-DP and Profibus-PA DeviceNet Modbus RTU
Program Cycle and I/O Scan	Floating scan from 5 ms (depends on the program extension)
Scaleable	Up to 15 local racks and up to 6 remote I/O sub-systems
Remote I/O	Up to 6 RIO sub-systems (maximum of 15 racks per sub-system)
OPC Server	Smar OPC server multi-channel (Ethernet and Serial combination)
Documentation	Many options to select from the configurator (CONF700)

Processor Module (CPU)



Part Number	Number of Ports	Port Connections	Remote I/O Port Type	Baud Rates:	Isolation on RS-485	Configuration Memory	Operation and Diagnostic LED's	Drawn Current from Internal 5 Vdc
CPU-700-C3	3 Independent Ports P1 - Modbus RTU (RS-232C) P2 - Modbus RTU (RS-485) P3 - Modbus RTU or Remote I/O (RS-485)	P1 - DB9 Female P2 and P3 - Terminals	Master*	P1 - 1200 bps to 57.6 Kbps P2 - 1200 bps to 115.2 Kbps P3 - as Modbus RTU 1200 bps to 115.2 Kbps P3 - as Remote I/O 57.6 Kbps to 460.8 Kbps	1600 Vrms @ 1 minute 2000 Vrms @ 1 second	EEPROM	Power Run Hold Safe External Power Failure	240 mA

* Remote I/O Port Works in Conjunction with RIO-700-3.

Remote I/O Interface



Part Number	Modbus RTU Port	Redundant Remote I/O Ports	Remote I/O Port Type	Baud Rates:	Isolation on RS-485	Configuration Memory	Operation and Diagnostic LED's	Drawn Current from Internal 5 Vdc
RIO-700-3	RS-232C (DB-9 Female)	Two RS-485 (Terminals)	Slave*	Modbus RTU Port - 1200 bps to 57.6 Kbps Remote I/O Ports - 57.6 Kbps to 460.8 Kbps	1600 Vrms @ 1 minute 2000 Vrms @ 1 second	EEPROM	Power Run Hold Safe External Power Failure	200 mA

* Remote I/O Port Works in Conjunction with CPU-700-C3 or CPU-700-C3R.

Power Supply Module (Redundant Capability)



Part Number	Operation Mode	Operating Voltages	Outputs (all isolated)	Diagnostic LED's	Relay for Failure Announcement
PS-AC-R (for AC input voltage) PS-DC-R (for DC input voltage)	Standalone or Standby	90 to 264 Vac - PS-AC-R 20 to 30 Vdc - PS-DC-R	5.1 Vdc +/- 2% @ 3 A 24 Vdc +/- 10% @ 300 mA	5 Vdc Indicator 24 Vdc Indicator Failure Indicator	Normally Closed

Redundant Processor Module (CPU)



Part Number	Redun-dancy Type	Con-figura-tion	Specific Features	Number of Ports	Port Connec-tions	Remote I/O Port Type	Baud Rates:	Isolation on RS-485	Config. Memory	Operation and Diagnostic LED's	Drawn Current from Internal 5 Vdc
CPU-700-C3R	Hot Standby	Main or Standby CPU	4 Independent Ports P1 - Modbus RTU (RS-232C) P2 - Modbus RTU (RS-485) P3 - Remote I/O (RS-485) ICP - Inter-CPU-Port for Data Updanting	Controller switchover in 40 ms Automatic Configuration and Parameters Bypass Self Configurable Based on Controlling CPU	P1 - DB-9 Female P2 and P3 - Terminals ICP - Phone Jack	Master*	P1 - 1200 bps to 57.6 Kbps P2 - 1200 bps to 115.2 Kbps P3 - 57.6 Kbps to 460.8 Kbps	1600 Vrms @ 1 minute 2000 Vrms @ 1 second	EEPROM	Power Run Hold Safe External Power Failure	240 mA

* Remote I/O Port Works in Conjunction with RIO-700-3

I/O Specifications

Fieldbus Module

The FB700 is a Fieldbus interface card for LC700 programmable controller. It integrates the discrete control capability of LC700 with Fieldbus.

FB700 is directly attached to LC700 backplane. LC700 accesses it as a regular I/O card, which supports many digital and analog I/O points mapped to the FB700 function blocks.

Connecting FB700 and PC Serial Port using the cable C232-700, the user is allowed to upgrade the firmware (executable program installed in the FLASH memory) of the equipment using the latest versions provided by Smar.

FB700 can execute the following pre-instantiated function blocks:

FOUNDATION

Qty	Function Block	Description	LC700 Block
1	PID	PID Controller	-
1	AALM	Analog Alarm	-
3	MDI	Multiple Discrete Input	CODD
4	MDO	Multiple Discrete Output	CIDD
2	MAI	Multiple Analog Input	COAD
2	MAO	Multiple Analog Output	CIAD

The function blocks Splitter (SPLT), Signal Characterize (CHAR), Integrator (INTG), Input Selector (ISEL), Setpoint Ramp Generator (SPG), Timer (TIME), Lead Lag (LLAG), Arithmetic (ARTH), Output Selector and Double Cross Limit (OSDL) can be instantiated as necessary.



Fieldbus Interface	Description
Number of Channels	1 H1 (31.25Kbps)
Controller	Smar FB3050 (integrated DMA)
Physical Layer Standard	IEC 1158-2
MAU Type	Passive (not bus powered)
Intrinsic Safety	NOT compliant
Isolation	500 VAC (each channel)
Operating Conditions	0..50 °C @ 5..90% RH
Non operating Conditions	-30..70 °C @ 5..90% RH
Operating Voltage	+5V +-5%
Operating Current	60mA (typ)

DeviceNet Scanner



Part Number	Number of Channels	Maximum Nodes	Baud Rates	Isolation	Field Connector	Configuration Memory	Operation LED's	Computer Port	Drawn Current from Internal 5 Vdc
DN-700	1	64	125, 250 and 500 Kbps	500 V Optical	Standard Phoenix 5-pin Terminal	Flash	Run Ready Network Module	RS-232 / DB-9 Male (Firmware Updates)	310 mA

Profibus-DP Scanner



Part Number	Number of Chan-nels	Maximum Nodes	Baud Rates	Isolation	Field Connector	Configuration Memory	Operation LED's	Computer Port	Drawn Current from Internal 5 Vdc
DP-700	1	125	9.6 K up to 12 Mpbs	500 V Optical	DB-9 Female	Flash	Run Ready State Error	RS-232C/ DB-9 Male (Firmware Updates)	610 mA

Ethernet 700 (Modbus/TCP) Module



Part Number	Open TCP Connections	Communi-cation Channels	Serial Baudrate	RS-485 Isolation	Maxi-mum Nodes	Compa-tibility	Mana-gement	Diagnostic LED´s	Firmware	Drawn Current from Internal 5 Vdc
ENET-700	Maximum of 8	10 Base-T (RJ45) RS-232C (DB-9 Female) RS-485 (Terminals)	300 bps to 38.4 Kbps	1600 Vrms @ 1 minute 2000 Vrms @ 1 second	125	Ethernet Version 2.0/IEEE 802.3	Telnet Login and SNMP (read only)	Transmit Data Receive Data Good Link Error Error Code	New software can be download via TFTP or serial port	270 mA

Digital Input



Part Number	Input Type	Input Points	Nominal Imput Voltage	Max. Input Voltage	Input Current	On Voltage	Off Voltage	On/Off Delay	Points per Group	Drawn Current from internal 5 Vdc	Module Circuit
M-001	DC	16	24 vdc	30 Vdc	7.5 mA	> 20 Vdc	< 5 Vdc	30 µs (On) 50 µs (Off)	8 pts	80 mA	Sink
M-002			48 vdc	60 Vdc		> 30 Vdc	< 9 Vdc				
M-003			60 vdc	75 Vdc		> 38 Vdc	< 12 Vdc				
M-004			125 vdc	140 Vdc		> 95 Vdc	< 25 Vdc				
M-005			24 vdc	30 Vdc		< 5 Vdc	> 20 Vdc				Source
M-010	AC	8	120 Vac	140 Vac	10 mA	> 100 Vac	< 30 Vac	5 ms (On) 42 ms (Off)	4 pts	50 mA	Sink
M-011			240 Vac	264 Vac		> 200 Vac	< 50 Vac				
M-012		16	120 Vac	140 Vac		> 100 Vac	< 30 Vac		8 pts	80 mA	
M-013			240 Vac	264 Vac		> 200 Vac	< 50 Vac				
M-020	Button	8	-	-	-	-	-	-		45 mA	-

Digital Output



Part Number	Output Type	Output Points	Output Voltage	Continuous Current per Point	Continuous Current per Group	On/Off Delay	Points per Group	Max. Leakage Current	Drawn Current from Internal 5 Vdc
M-101	Transistor	16	30Vdc	0.5 A (sink)	4 A	250 µs(On)/3 µs (Off)	16	100 µA	70 mA
M-102	Transistor	16	65Vdc	1 A (Source)	8 A	250 µs(On)/50 µs (Off)	8	200 µA	
M-110	Triac	8	20 to 240Vdc	1 A	4 A (40 °C) 2 A (60 °C)	½ cycle	4	0.5 mA at 100 Vac (RC Snubber)	
M-111		16					8		115 mA
M-120	Relay	4 NO 4 NO	250 Vac 110 Vdc	5 A at 250 Vac 5 A at 24 Vdc		10 ms	4		20 mA
M-121		4 NC 4 NC							
M-122		4 NO 4 NC							
M-123		8 NO 8 NO			10 A		8	-	70 mA
M-124		4 NO 4 NO					4	-	20 mA
M-125		4 NC 4 NC							
M-126		4 NO 4 NC							

Analog/Temperature Input



Part Number	Input Range	Input Channels	Resolution	Input Impedance	Accuracy	Conversion Speed	Drawn Current from Internal 5 Vdc
M-401	0-5 V, 1-5 V, 0-10 V	8 ch	16 bits	1 MΩ	+/- 0,1% of span	20 ms	50 mA
	+/- 10 V				+/- 0,2 of span		
M-401-R M-401DR	0-20 mA, 4-20 mA			250 Ω	+/- 0,12% of max. span		
	0-5 V, 1-5 V, 0-10 V			1 MΩ	+/- 0,1% of max. span		
	+/- 10 V				+/- 0,2% of max. span		
M-402	RTD: Cu10, Ni120, Pt50, Pt100, Pt500 Thermocouple: B, E, J, K, N, R, S, T, L, U (individually configurable/ cold junction compensation)	8 ch	16 bits	1 MΩ	+/- 0,05% of maximum span	90 ms	20 mA

* Obs: The inputs of the M-401-DR are differential and isolated among them (minimum of 10 MΩ).

Digital Input/Output



Part Number	Input Type	Output Type	Input Points	Output Points	Input Specifications	Output Specifications	Drawn Current from Internal 5 Vdc
M-201	DC	Relay	8	4	see M-001	see M-120	60 mA
M-202					see M-002		
M-203					see M-003		
M-204					see M-001	see M-121	
M-205					see M-002		
M-206					see M-003		
M-207					see M-001	see M-122	
M-208					see M-002		
M-209					see M-003		

Analog Output



Part Number	Output Range	Output Channels	Resolution	Load Impedance	Accuracy 25 °C	Conversion Speed	Drawn Current from Internal 5 Vdc	Drawn Current from External 24 Vdc
M-501	4-20 mA, 0-20 mA, 0-5 V, 1-5 V, 0-10 V, +/- 5 V, +/- 10 V	4 ch in current and 4 ch in voltage	12 bits	5 V: 2 kΩ 20 mA: 750Ω	+/- 0,5%	8 ms	20 mA max.	180 mA max.

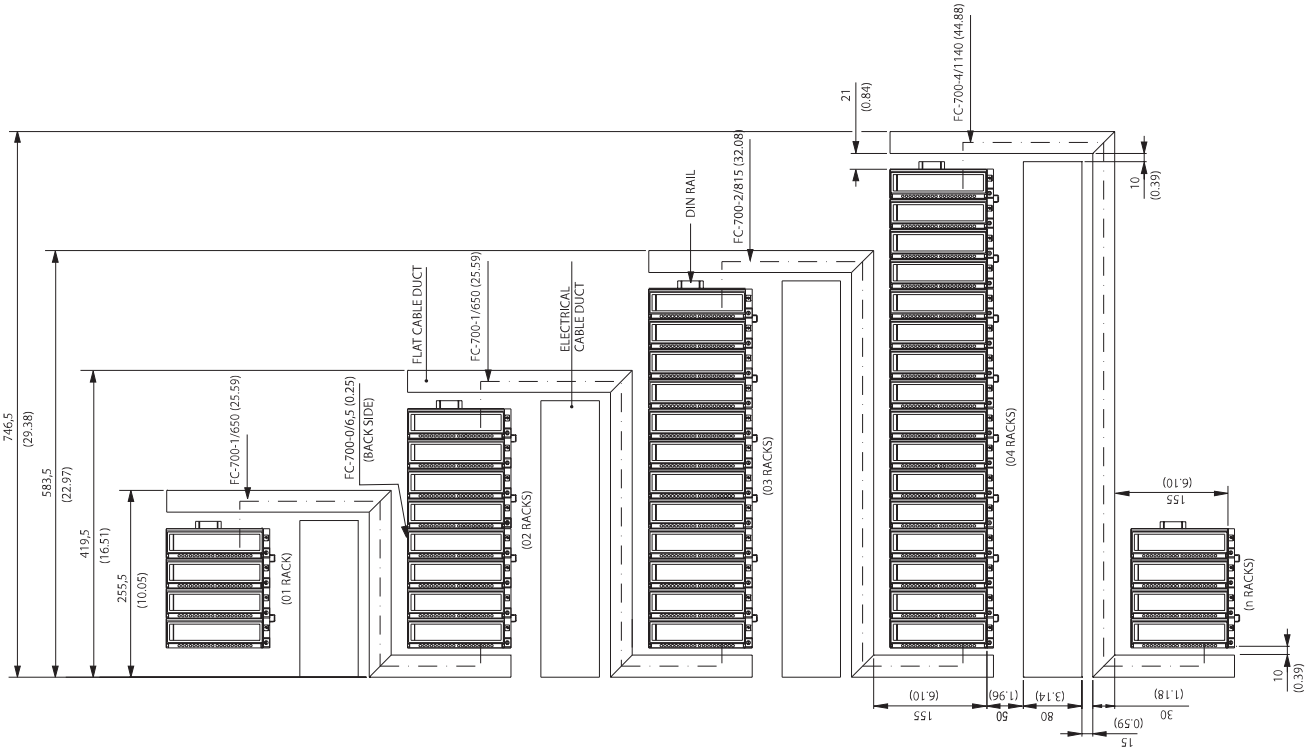
Pulse Input



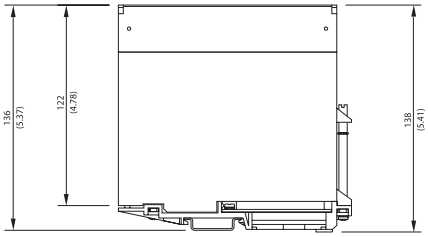
Part Number	Input Type	Input Points	Nominal Input Voltage	Max. Input Voltage	Input Current	On Voltage	Off Voltage	Points per Group	Counting Speed	Drawn Current from Internal 5 Vdc	Module Circuit
M-302	DC	16	24 Vdc	30 Vdc	7.5 mA	< 5 Vdc	> 20 Vdc	8	100 Hz	80 mA maximum	Source
M-303									10 kHz	126 mA maximum	

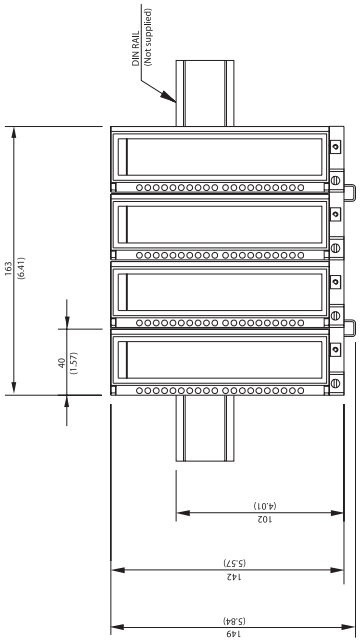
DIMENSIONS

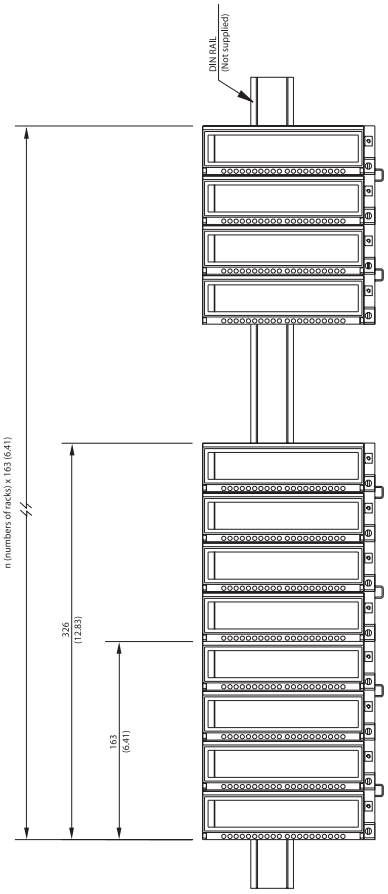
Connection of Local Expansion



Dimensions in mm (inch)







Basic Components

Name	Description	Part Number
CPU Module	30 kbytes E2PROM - Real Time Clock - 15MHz 3 - channel with Remote I/O (Master) 30 kbytes E2PROM - Real Time Clock - 15MHz 3 - channel with Remote I/O (Master) (Redundancy Capability) 6 kbytes E2PROM - 15MHz with Remote I/O (Slave)	CPU-700-C3 CPU-700-C3R RIO-700-3
Power Supply Module	Input: 90-264 Output: 5V @ 3A, 24V @ 0.3A (with Redundancy Capability) Input: 20-30 Output: 5V @ 3A, 24V @ 0.3A	PS-AC-R PS-DC-R
Rack	Rack with 4 Slots	R-700-4
Terminator	Terminator for the Last Rack	T-700
Flat Cable	Flat Cable to Connect Two Racks - Length 2.5 in Flat Cable to Connect Two Racks - Length 25.6 in Flat Cable to Connect Two Racks - Length 32.0 in Flat Cable to Connect Two Racks - Length 38.5 in Flat Cable to Connect Two Racks - Length 44.9 in	FC-700-0 FC-700-1 FC-700-2 FC-700-3 FC-700-4
Flat Cable Connection Kit	Used to extend Flat Cables	FCC-CONN
Cable for Local Configuration (RS-232)	Computer - LC700/FB700 cable for EIA-232 (72 in)	C232-700
Configurator of the LC700	Software for Hardware Configuration, Programming and Optimization (Windows™ 9x, 2000,NT)	CONF700
Blind Module	To fill in empty slots	M-000
Inter-CPU Cabel	Cable for CPU redundancy	ICP-700
OPC-Server	OPC-Server to Smar LC700 System	OPC-700
Ethernet Switch	Ethernet Switch 10/100 bps	DF61

I/O Modules

Name	Description	Part Number
DC Input	2 Groups of 8 24 Vdc Inputs (Isolated) current sinking inputs 2 Groups of 8 48 Vdc Inputs (Isolated) current sinking inputs 2 Groups of 8 60 Vdc Inputs (Isolated) current sinking inputs 2 Groups of 8 125 Vdc Inputs (Isolated) current sinking inputs 2 Groups of 8 24 Vdc Inputs (Isolated) current sourcing inputs	M-001 M-002 M-003 M-004 M-005
AC Input	2 Groups of 4 120 Vac Inputs (Isolated) 2 Groups of 4 240 Vac Inputs (Isolated) 2 Groups of 8 120 Vac Inputs (Isolated) 2 Groups of 8 240Vac Inputs (Isolated)	M-010 M-011 M-012 M-013
On/Off Switches	1 Group of 8 On/Off Button	M-020
Transistor Output	1 Group of 16 Open Collector Driver Outputs (Isolated) 2 Groups of 8 Transistor Output (Source)	M-101 M-102
Triac Output	2 Groups of 4 120/240 Vac Outputs (Isolated) 2 Groups of 8 120/240 Vac Outputs (Isolated)	M-110 M-111
Relay Output	2 Groups of 4 NO Relay Outputs (Double Level of Isolation) with Snubber 2 Groups of 4 NC Relay Outputs (Double Level of Isolation) with Snubber 1 Group of 4 NO and 1 Group of 4 NC Relay Outputs (Double Level of Isolation) with Snubber 2 Groups of 8 NO Relay Outputs (Double Level of Isolation) 2 Groups of 4 NO Relay Outputs (Double Level of Isolation) 2 Groups of 4 NC Relay Outputs (Double Level of Isolation) 1 Group of 4 NO Relay Outputs and 1 Group of 4 NC Relay Outputs (Double Level of Isolation)	M-120 M-121 M-122 M-123 M-124 M-125 M-126
DC Input / Relay Output	1 Group of 8 24 Vdc Inputs and 1 Group of 4 NO Relays (Isolated) 1 Group of 8 48 Vdc Inputs and 1 Group of 4 NO Relays (Isolated) 1 Group of 8 60 Vdc Inputs and 1 Group of 4 NO Relays (Isolated) 1 Group of 8 24 Vdc Inputs and 1 Group of 4 NC Relays (Isolated) 1 Group of 8 48 Vdc Inputs and 1 Group of 4 NC Relays (Isolated) 1 Group of 8 60 Vdc Inputs and 1 Group of 4 NC Relays (Isolated) 1 Group of 8 24 Vdc Inputs and 1 Group of 2 NO and 2 NC Relays (Isolated) 1 Group of 8 48 Vdc Inputs and 1 Group of 2 NO and 2 NC Relays (Isolated) 1 Group of 8 60 Vdc Inputs and 1 Group of 2 NO and 2 NC Relays (Isolated)	M-201 M-202 M-203 M-204 M-205 M-206 M-207 M-208 M-209
Analog Input	8 Channels 0-5 V, 1-5 V, 0-10 V, +/- 10 V without 250Ω resistor 8 Channels 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, 0-10 V, +/-10 V with Internal 250Ω shunt 8 Channels 0-20 mA, 4-20 mA, 0-5 V, 1-5 V, 0-10 V, +/-10 V with Internal 250Ω shunt individualy isolated 8 Channels - RTD: Cu10,Ni120, Pt50, Pt100, Pt500 - Thermocouple: B, E, J, K, N, R, S, T, L, U	M-401 M-401-R M-401-DR M-402
Analog Output	4 Channels 4-20 mA, 0-20 mA, 0-5 V, 1-5 V, 0-10 V, +/-5 V, +/-10 V	M-501
Pulse Input	16 Channels - low speed counting sinking Module 16 Channels - high speed counting sinking Module	M-302 M-303
Fieldbus Module	1 Channel Fieldbus	FB-700
Ethernet Module	Modbus/TCP to Modbus RTU Converter	ENET-700
Profibus Module	Profibus-DP and Profibus-PA High Performance Master Scanner	DP-700
DeviceNet Module	DeviceNet High Performance Master Scanner	DN-700
Modbus Module	Modbus Master Scanner	MB-700