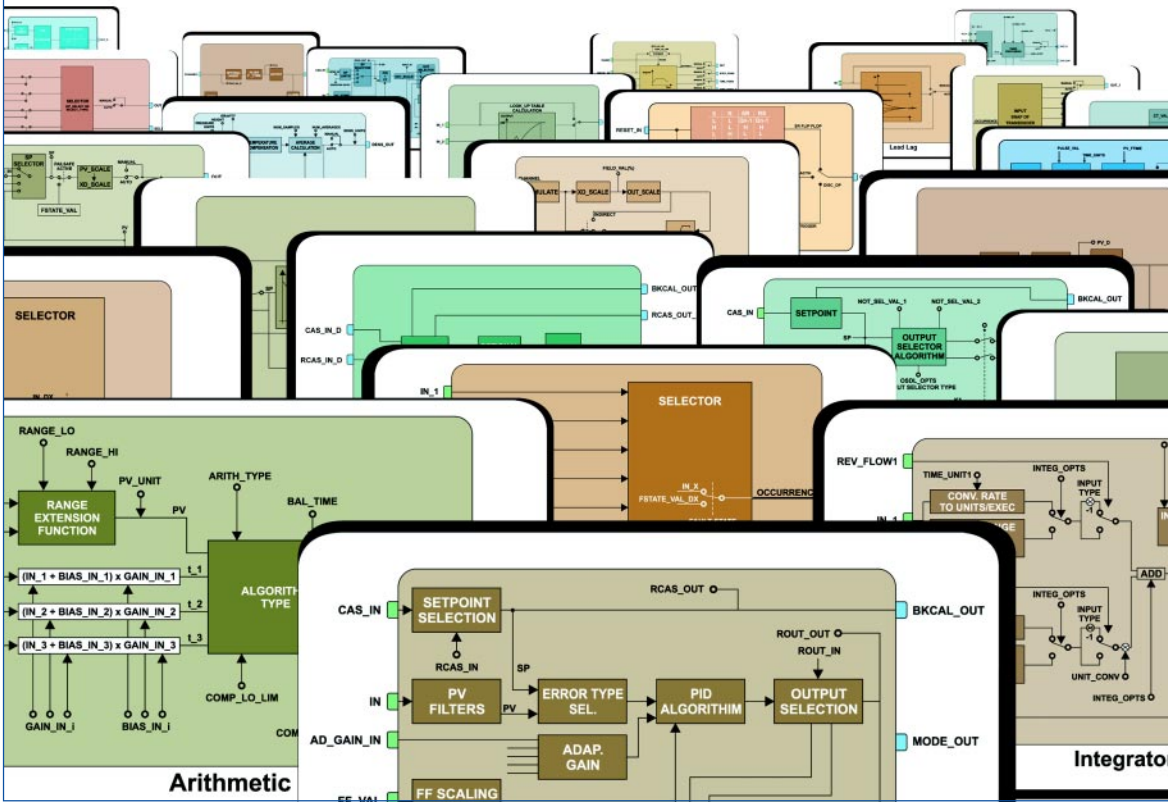
Function Blocks

Function Block Library

The Function Block Library of SYSTEM302 was designed to be powerful and flexible allowing implementing the majority of process control strategies. Some function blocks were already tested and approved in the Interoperability Test (AI, PID and AO), and Fieldbus Foundation will be able to test other function blocks in the future. Smar has developed some function blocks to the best fit with our customer requirements, as the Advanced PID, Density, OSDL (Output Signal Selector and Dynamic Limiter) and others. However any of these function blocks may be configured by any Foundation Fieldbus configurator due to the Device Description (DD) technology, as well they may be linked to any other function block.

A Function Block is a logical grouping of related functionality.



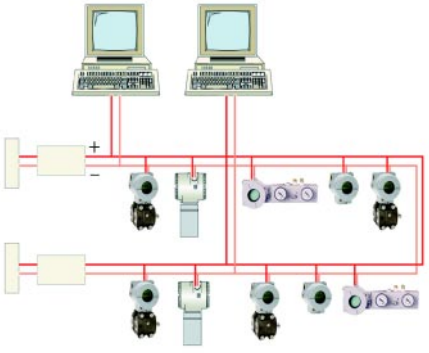
Instantiation and Deletion of Function Blocks

This feature provides huge flexibility to implement the control strategy, because the user can define which function blocks will be instantiated in each field device at the strategy configuration time.

It means na optimization of field device resources usage, therefore memory and processing time are allocated according to the real need.

All field devices (LD302, TT302, IF302, TP302, DT302, FY302, FP302 e FI302) and FB700 has capability up to 20 blocks selectable from a Function Block Library with 17 different algorithms, at least. The function block library of the DFI302 includes all the algorithms developed for the field devices as well Step Output PID, Pulse Input, SR Flip-flop, Edge Trigger and others.

Devices are easily connected in parallel to the Fieldbus network.

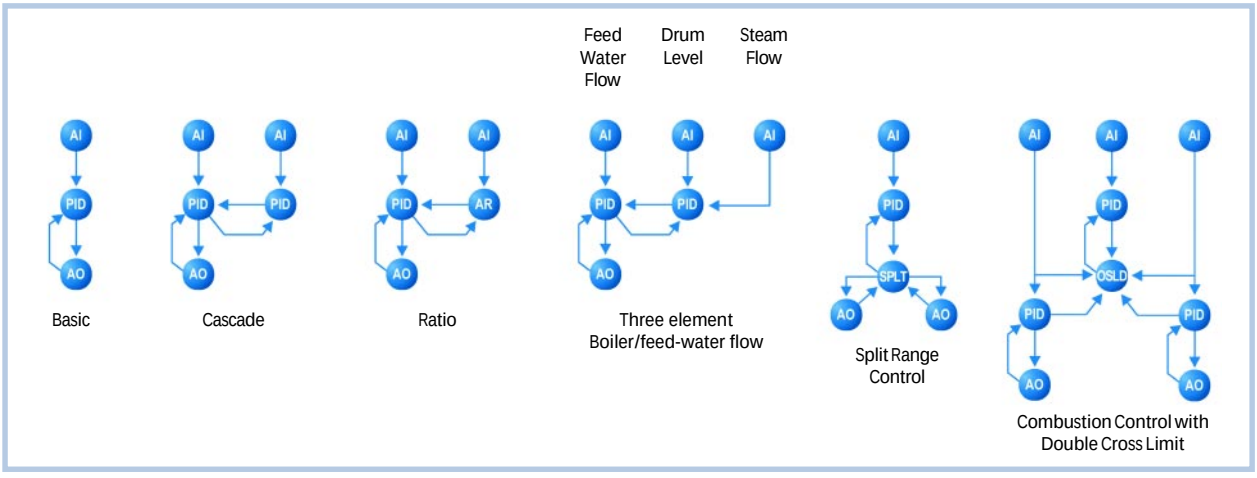


All devices on the H1 Fieldbus communicate with each other peer-to-peer using a publisher/ subscriber relationship for high efficiency and synchronization. A Fieldbus network may be almost 2 km in length and repeaters may be used for even longer distances. The Fieldbus provides power for the 2 wire devices, and acts as media for the digital communication. In a typical system a total of 12 to 16 devices powered by the bus, relating to 6 - 8 control loops, are multidropped on the Fieldbus network.

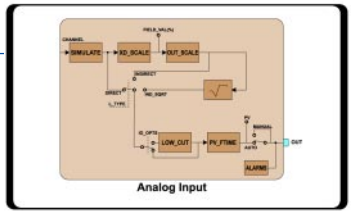
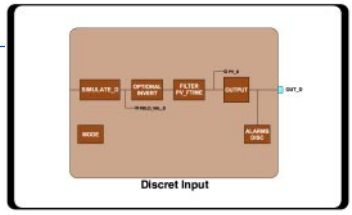
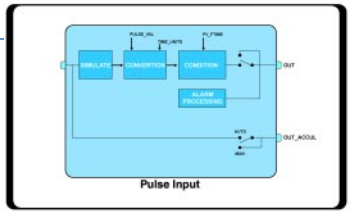
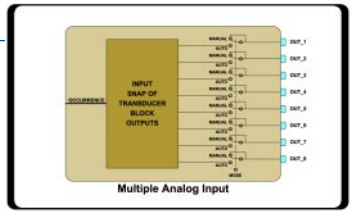
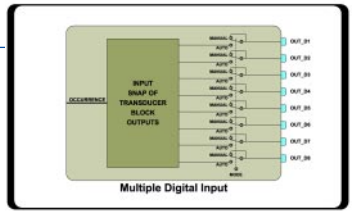
The Function Block language is ideal for process control strategy building.

Cascade control, ratio control, feed-forward, cross-limit and other control strategies are easily configured by linking the function blocks in the various devices in the system.

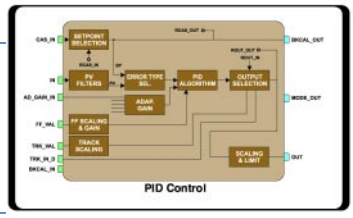
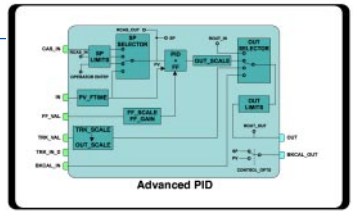
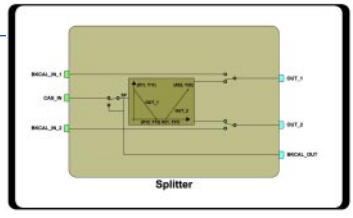
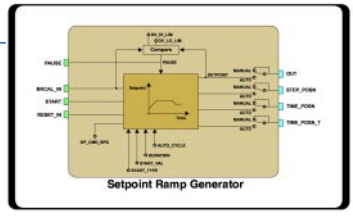
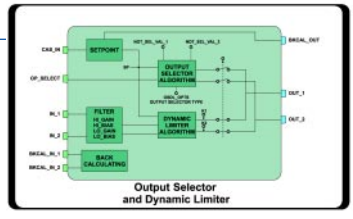
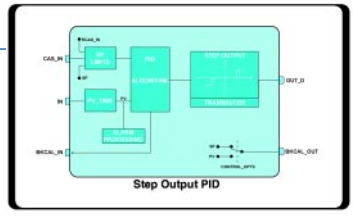
More than two dozen standard function blocks are available to perform regulatory control functions.



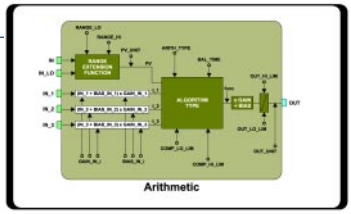
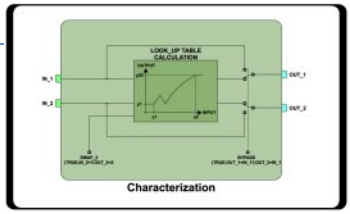
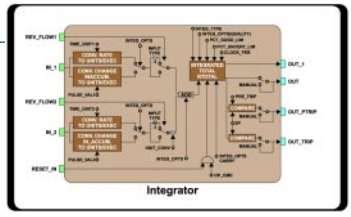
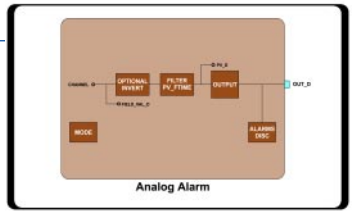
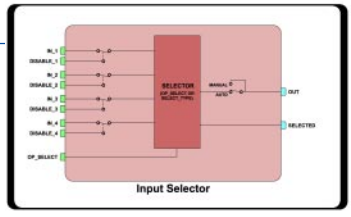
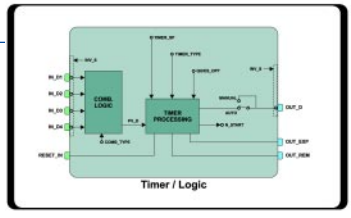
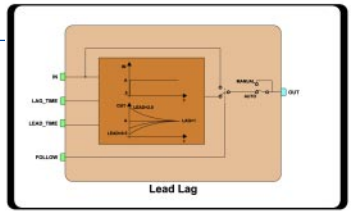
Input

BLOCK	SCHEMATIC	DESCRIPTION
AI	 Analog Input	***ANALOG INPUT*** - This block takes the input data from the transducer block and makes it available to other function blocks. It has scaling conversion, filtering, square root and low cut.
DI	 Discret Input	***DISCRETE INPUT*** - The DI block takes the manufacturer's discrete input data, selected by channel number, and makes it available to other function blocks at its output.
PUL	 Pulse Input	***PULSE INPUT*** - It provides an analog value that represents a totalization of pulses in a physical discrete input.
MAI	 Multiple Analog Input	***MULTIPLE ANALOG INPUT*** - It provides a way to receive 8 analog variables from the LC700 or physical inputs.
MDI	 Multiple Digital Input	***MULTIPLE DISCRETE INPUT*** - It provides a way to receive 8 discrete variables from the LC700 or physical inputs.

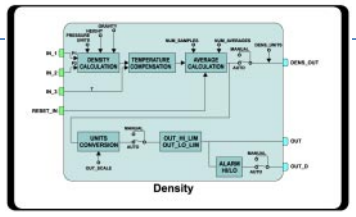
Control

BLOCK	SCHEMATIC	DESCRIPTION
PID		***PID CONTROL*** - This standard block has a lot of valuables features as setpoint treatment (value and rate limiting), filtering and alarm on PV, feedforward, output tracking and others.
EPID		***ENHANCED PID*** - It has all the standard features plus : bumpless or hard transfer from a "manual" mode to an "automatic" mode and bias.
APID		***ADVANCED PID*** - It has all the standard features plus: bumpless or hard transfer from a "manual" mode to an "automatic" mode, bias. Adaptive gain, PI sampling, deadband for error, special treatment for error, ISA or parallel algorithm,..
SPLT		***SPLITTER*** - This block is used in two typical applications: split ranging and sequencing. It receives the output of PID block, that is processed according to the selected algorithm, then it generates the values for the two analog output blocks.
SPG		***SETPOINT RAMP GENERATOR*** - This block generates setpoint following a profile in function of the time. Typical applications are temperature control, batch reactors, etc.
OSDL		***OUTPUT SELECTOR / DYNAMIC LIMITER*** - It has two algorithms: · Output selector - selection of output by a discrete input · Dynamic limiter - this algorithm was developed specially for double cross limit in combustion control.
STEP		***STEP OUTPUT PID*** - It is used when the final control element has an actuator driven by an electric motor.

Calculate

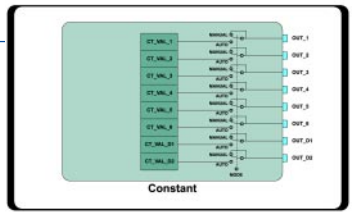
BLOCK	SCHEMATIC	DESCRIPTION
ARTH		***ARITHMETIC*** - This calculation block provides some pre-defined equations ready for use in applications as flow compensation, HTG, ratio control and others.
CHAR		***SIGNAL CHARACTERIZER*** - It has capability for two signal characterization based on the same curve. The second input has an option for swapping "x" to "y", providing an easy way to use the inverse function, that may be used in signal characterization of readback variables.
INTG		***INTEGRATOR*** - It integrates a variable in function of the time. There is a second flow input that may be used for the following applications: net flow totalization, volume/mass variation in vessels and precise flow ratio control.
AALM		***ANALOG ALARM*** - This alarm block has dynamic or static alarm limits, hysteresis, temporary expansion of alarm limits on step setpoint changes to avoid nuisance alarms, two levels of alarm limits and delay for alarm detection.
ISEL		***INPUT SELECTOR*** - This block has four analog inputs that may be selected by an input parameter or according to a criterion as first good, maximum, minimum, middle and average.
TIME		***TIMER*** - This block has four discrete inputs, that are processed by a combination logic. The selected timer processing type operates on the combined input signal to produce a measurement, delay, extension, pulse or debounce.
LLAG		***LEAD-LAG*** - This block provides dynamic compensation of a variable. It is used normally in a feedforward control.

DENS



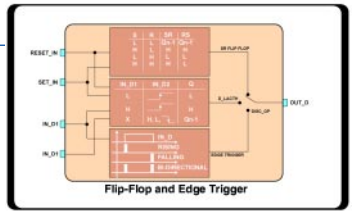
DENSITY - This block has a special algorithm to calculate the density in different types of engineering units: plato degree, INPM and others.

CT



CONSTANT - It provides analog and discrete output parameters with constant values.

FFET

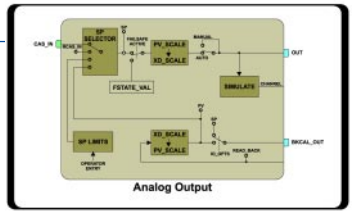


FLIP-FLOP AND EDGE TRIGGER - It can be configured to work as SR flip-flop, RS flip-flop, D-LATCH and EDGE TRIGGER (rising, falling or bi-directional)

Output

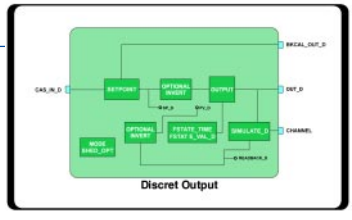
BLOCK SCHEMATIC DESCRIPTION

AO



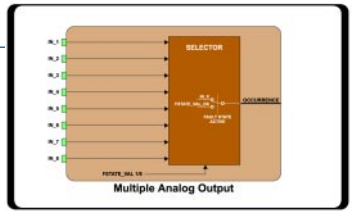
ANALOG OUTPUT - The AO block provides a value to an output transducer block. It provides value and rate limiting, scaling conversion, fault state mechanism and other features.

DO



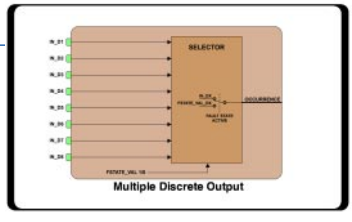
DISCRETE OUTPUT - The DO block converts the value in SP_D to something useful for the hardware found at the CHANNEL selection.

MAO



MULTIPLE ANALOG OUTPUT - It provides a way to send 8 analog variables to the LC700 or physical outputs.

MDO



MULTIPLE DISCRETE OUTPUT - It provides a way to send 8 discrete variables to the LC700 or physical outputs.

Transducer/ Resource

BLOCK	
RS	***RESOURCE*** **-** This block contains data that is specific to the hardware that is associated with the resource.
TRD	***TRANSDUCER BLOCK*** **-** This block converts the primary variables of the physical I/O devices into the proper engineering value requested by the function blocks.
DIAG	***DIAGNOSTICS TRANSDUCER*** **-** It provides online measurement of block execution time, check of links between blocks and other features.
DSP	***DISPLAY TRANSDUCER*** **-** This block configures what process variables of the function blocks will be displayed in the device LCD panel.
HC	***HARDWARE CONFIGURATION TRANSDUCER*** **-** It configures the module type for each slot in the DFI302.
TEMP	***TEMPERATURE DF-45 TRANSDUCER*** **-** This is the transducer block for the module DF-45, an eight low signal input module for RTD, TC, mV, Ohm.

Task distribution

Smar engineers have developed a system of very powerful field devices, based on the Fieldbus Foundation technology, capable of taking the place of the DCS. SYSTEM302 is a Fieldbus Control System where time-critical functions are performed primarily in the field devices. Time-critical functions may also be executed in traditional multifunction controllers resulting in an incredibly flexible solution suitable for large and small systems. Other functions, that the control system is required to perform, are executed in the operator workstation thereby providing a complete solution. SYSTEM302 performs the same task as conventional DCS systems, and more.

Field	Controllers	Workstation
Measurement	Control	Display
Actuation	Logic	Operation
Control	Sequence	Process Flow Mimic
Computation	Computation	Trend
Selection	Selection	Alarm
Alarm	Alarm	Reports
Diagnostics	Diagnostics	Supervisory
		Batch
		Recipe
		Events
		SQC
		Database management
		Instrument management
		Optimization
		ERP - Enterprise Resource Planning