Analog Current Input - 16 Channel
IC693ALG223

The ***16-Channel Analog Current Input*** module provides up to 16 single-ended input channels, each capable of converting an analog input signal to a digital value for use as required by your application. This module provides three input ranges:

- 4 to 20 mA
- 0 to 20 mA
- 4 to 20 mA Enhanced

Current Ranges

The default range is 4 to 20 mA with user data scaled so that 4 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. The other ranges are selected by changing the configuration parameters using the IC641 configurator software or the Hand-Held Programmer. The range can be configured so that the input range is 0 to 20 mA with user data scaled so that 0 mA corresponds to a count of 0 and 20 mA corresponds to a count of 32000. Full 12-bit resolution is available over the 4 to 20 and 0 to 20 mA ranges.

A 4 to 20 mA Enhanced range can also be selected. When this range is selected, 0 mA corresponds to a count of –8000, 4 mA corresponds to a count of 0 (zero) and 20 mA corresponds to a count of +32000. The Enhanced range uses the same hardware as the 0 to 20 mA range but automatically provides 4 to 20 mA range scaling with the exception that negative digital values are provided to the user for input current levels between 4 mA and 0 mA. This gives you the capability of selecting a low alarm limit that detects when the input current falls from 4 mA to 0 mA, which provides for open-wire fault detection in 4 to 20 mA applications. High and Low alarm limits are available on all ranges. Ranges can be configured on a per channel basis. The module also reports module status and user-side supply status to the CPU.

Power Requirements and LEDs

This module consumes 120 mA from the 5V bus on the PLC backplane and also requires 65 mA plus current loop current(s) from a user supplied +24V supply (see Table 3-13, *Specifications*).

There are two green LED indicators on the module which provide module and user supply status. The top LED, **MODULE OK** provides module status information on power-up as follows:

- *ON*: status is OK, module configured;
- *OFF*: no backplane power or software not running (watchdog timer timed out);
- *Continuous rapid flashing*: configuration data not received from CPU;
- *Slow flashes, then OFF*: failed power-up diagnostics or encountered code execution error.

The bottom LED, **User Supply OK**, indicates that the user provided 24V supply is within specifications, thereby enabling the analog side of the module to work properly.

Location in System

This module can be installed in any I/O slot of a 5 or 10-slot baseplate in a Series 90-30 PLC system.

References Used

The number of 16-Channel Analog Current Input modules which may be installed in a system depends on the amount of %AI and %I references available. Each module uses 1 to 16 %AI references (depending on the number of channels enabled) and from 8 to 40 %I (depending on alarm status configuration) references.

The available %AI references are: 64 in a Model 311, Model 313, and Model 323 system, 128 in a Model 331 system, 1024 in a Model 340 and 341 system, and 2048 in a Model 351 and Model 352 system.

The maximum number of 16-Channel Analog Current Input modules which may be installed in a system are:

- 4 in a Model 311, Model 313, and Model 323 system
- 8 in a Model 331 system
- 12 in a Model 340 and Model 341 system
- 51 in a Model 351 and Model 352 system

When planning the module configuration for your application you must also consider the load capacity of the installed power supply and the total load requirements of all modules that are installed in the baseplate.

Refer to the *Series 90-30 Programmable Controller Installation Manual*, GFK-0356 for details on power supplies and module load requirements.

Table 10-7. Specifications for 16-Channel Analog Current Input Module, IC693ALG223

Number of Channels	1 to 16 selectable; single ended
Input Current Ranges	0 to 20 mA, 4 to 20 mA and 4 to 20 mA Enhanced (selectable per channel)
Calibration	Factory calibrated to: 4 µA per count on 4 to 20 mA range 5 µA per count on 0 to 20 mA and 4 to 20 mA Enhanced range
Update Rate	13 msec (all 16 channels)
Resolution at 4-20 mA	4 µA (4 µA/bit)
Resolution at 0-20 mA	5 µA (5 µA/bit)
Resolution at 4-20 mA Enhanced	5 µA (5 µA/bit)
Absolute Accuracy †	± 0.25% of full scale @ 25°C (77°F): ± 0.5% of full scale over specified operating temperature range
Linearity	< 1 LSB from 4 to 20 mA (4 to 20 mA range) < 1 LSB from 100 µA to 20 mA (0 to 20 mA and 4 to 20 mA Enhanced ranges)
Isolation	1500 volts between field side and logic side
Common Mode Voltage	0 volts (single-ended channels)
Cross-Channel Rejection	> 80 db from DC to 1 kHz
Input Impedance	250 ohms
Input Low Pass Filter Response	19 Hz
External Supply Voltage Range	20 to 30 VDC
External Supply Voltage Ripple	10%
Internal Power Consumption	120 mA from the +5 volt bus on the backplane 65 mA from 24 VDC external user supply (in addition to current loop currents)

Refer to data sheet GFK-0867C, or later revision for product standards and general specifications.

† In the presence of severe RF interference (IEC 801-3, 10V/m), accuracy may be degraded to ±5% FS.

CPU Interface to the IC693ALG223 Analog Current Input Module

The Series 90-30 PLC uses the data within the %AI data table to record analog values for use by the programmable controller. This scheme is shown in Figure 3-25 for the 16-Channel Analog Current Input module. *More detailed information on the CPU interface to analog modules can be found at the beginning of this chapter.*

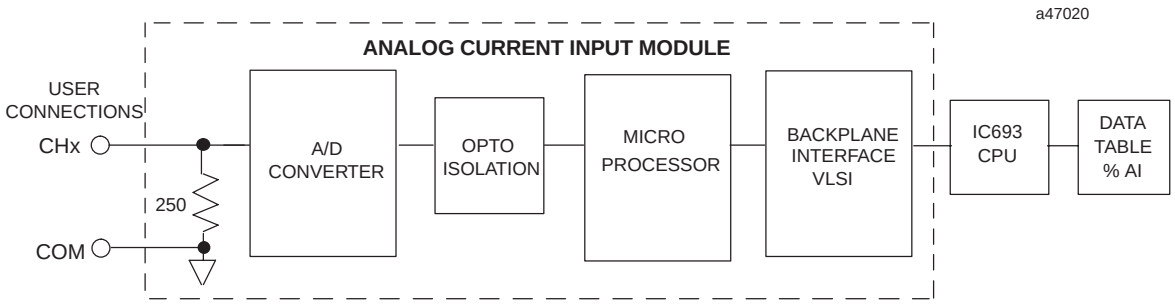


Figure 10-14. 16-Channel Analog Current Input Module Block Diagram - IC693ALG223

Placement of A/D Bits within the Data Tables

Since converters used in the analog modules are 12-bit converters, not all of the 16 bits in the data tables contain data required for the conversion. A version of the 12 bits is placed within the 16-bit data word corresponding to the analog point (in the %AI table). The Series 90-30 PLC system handles the integration differently for the various analog modules.

The CPU does not manipulate the data from the input modules before placing it within the word in the %AI data table. The bits in the %AI data table which were not used in the conversion by the input module are forced to 0 (zero) by the analog input module. Placement of the 12 data bits from the A/D converter for an analog current input data word for the 16-Channel Analog Current Input module is shown below.

MSB															LSB
X	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	X	X	X

X=not converted bits

Analog values are scaled over the range of the converter. Factory calibration adjusts the analog value per bit (resolution) to a multiple of full scale (that is, 4 µA/bit). This calibration leaves a normal 12-bit converter with 4000 counts (normally 2^{12} = 4096 counts). The data is then scaled with the 4000 counts over the analog range. For example, the data to the A/D converter for the 16-Channel Analog Current Input is scaled as shown in the following figure.

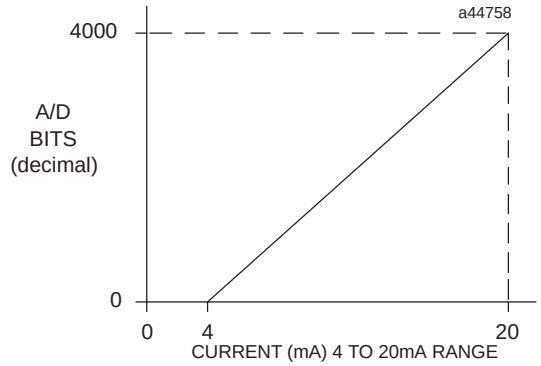


Figure 10-15. A/D Bits vs. Current Input for IC693ALG223

IC693ALG223 Configuration

The 16-Channel Analog Current Input module can be configured using either the Logicmaster 90-30/20/Micro or CIMPLICITY Control Programming Software configurator function, or with the Hand-Held Programmer.

The parameters that may be configured are described in the following table. Configuration procedures using Logicmaster 90-30/20/Micro Programming Software and the Hand-Held Programmer are described in the following pages.

Table 10-8. Configuration Parameters

Parameter Name	Description	Values	Default Values	Units
Active Channels	Number of channels converted	1 through 16	1 (Logicmaster 90-30/20/Micro) 16 (Hand-Held programmer)	n/a
Ref Adr	Starting address for %AI reference type	standard range	%AI0001, or next highest available address	n/a
Ref Adr	Starting address for %I reference type	standard range	%I00001, or next highest available address	n/a
%I Size	Number of %I status locations	8, 16, 24, 32, 40	8 (Logicmaster 90-30/20/Micro) 40 (Hand-Held Programmer)	bits
Range	Type of input and range	4-20, 0-20, or 4-20+ (Enhanced)	4-20	n/a
Alarm Low	Low limit alarm value	–8000 to +32759	0	User counts
Alarm High	High limit alarm value	–7999 to +32760	+32000	User counts

For more information on configuration, see

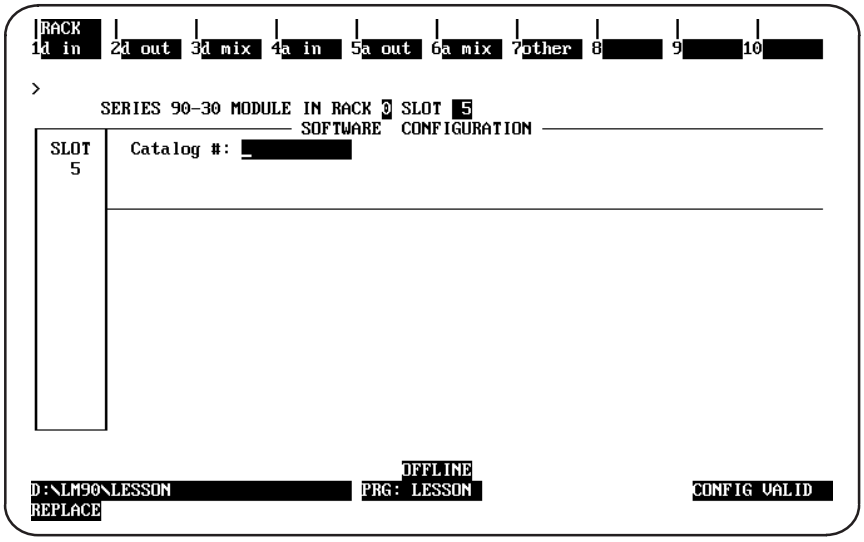
- *Configuration Using Logicmaster 90-30/20/Micro Programming Software* beginning on page 3-42
- *Configuration Using the Hand-Held Programmer* beginning on page 3-46

Configuring IC693ALG223 Using Logicmaster Software

This section describes how you can configure the 16-Channel High Density Analog Current Input module using the configurator function in Logicmaster 90-30/20/Micro programming software. *Configuration can also be done using CIMPLICITY Control Programming Software. For details refer to the CIMPLICITY Control online help.*

To configure a 16-Channel Analog Input Module on the I/O Configuration Rack screen:

1. Move the cursor to the slot where the module will be located, and press the **m30 io** softkey (F1). In the following example screen, the module will be placed in slot 5 of the main rack.



2. Press the **a in**, softkey (F4) to display a list of available analog input modules and their catalog numbers.