10.4 AI780

10.4.1 General Information

The AI780 is an 8-channel analog input module. The channels are single channel isolated. An individual analog/digital converter is used for each channel.

An electrically isolated encoder supply is created for each channel from a 24 VDC module supply.

10.4.2 Order Data

Model Number	Short Description	Figure
3AI780.6	2005 analog input module, 8 inputs, 0 to 20 mA, 16-bit, 24 VDC encoder supply, single channel isolation and encoder supply. Order 2 x TB718 terminal blocks separately.	

Table 202: AI780 order data

10.4.3 Technical Data

Product ID	AI780
General Information	
C-UL-US Listed	In preparation
B&R ID Code	$84
Can be Installed on Main Rack Expansion Rack	 Yes Yes

Table 203: AI780 technical data

Product ID	AI780
Static Characteristics	
Module Type	B&R 2005 I/O module
Input Type	Current Signal 0 - 25 mA
Number of Inputs	8
Module Supply	24 VDC ±10% (21.6 - 26.4 VDC)
Encoder Supply General Information	An electrically isolated encoder supply is created from the module supply for each channel.
Encoder Supply Voltage Current	 Module supply -15% / +25% Max. 30 mA
Common Potential between Channels	None (single channel isolation)
Protection of all Channels against Incoming Voltage and Reverse Polarity	Up to 30 VDC
Overload Display	LED
Output of the Digital Value during Overload Limits Exceeded Limits not Reached	Depends on module configuration $7FFF $8001
Digital Converter Resolution	16-bit
Data Format Delivered to the Application Program Default setting 0 mA 20 mA	INT $0000 $7FFF
Conversion Method	Sigma Delta
Conversion Time for all Channels Continuous Mode 50 Hz 60 Hz Trigger Mode 50 Hz 60 Hz	 20 ms 16.67 ms 60 ms 50 ms
Input Impedance in Signal Range	Max. 400 Ω
Zero Error at 25° C	±0.005% 1)
Basic Accuracy at 25° C	±0.05% 1)
Offset Drift	±0.001%/°C 1)
Gain Drift	±0.007%/°C 2)
Common Mode Range	±300 VAC/VDC
Noise (Peak to Peak)	±0.001% 1)
Cross-talk between Channels for DC Voltage, 50 Hz, 60 Hz and up to 300 VAC/VDC	<1 LSB
Linearization Method	Electronic compensation on the module Measurement value adjustment can be made by the user using application software

Table 203: AI780 technical data (cont.)

Product ID	AI780
Measurement Ranges	0 - 25 mA @ converter resolution 16-bit
Wiring	See 10.4.7 "Connection Examples", on page 342
Power Consumption internal 5 V 24 V Total Module Supply	 Max. 1.5 W --- Max. 1.5 W Max. 14 W
Dynamic Characteristics	
Total System Input Transfer Time	System dependent, cyclic in task class intervals
Analog filter Cut-off Frequency Attenuation Step-response	 80 Hz 20 dB/Decade 63% in 2 ms
Digital filter for first notch frequency of 50 Hz and 60 Hz	>120 dB
Maximum short term deviation during every defined electrical disturbance check	±1%
Operating Characteristics	
Operating Voltage Channel to Ground Channel to Channel	 Max. 300 V_{eff} Max. 600 V_{eff}
Pulse Dielectric Strength at 2000 m above Sea Level Channel to Ground Channel to Channel	 4000 V 4000 V
Operating Modes Operating Mode 1 Operating Mode 2	For a more detailed explanation see section 10.4.10 "Operating Modes", on page 345 continuous mode (Standard Mode) Trigger mode
Calibrating or Testing for Maintaining the Accuracy Class	None
Non-Linearity	<0.003% 1)
Operational conditions	
Environmental temperature during operation	0 to +60° C (see also section 10.4.9 "Derating", on page 345)
Relative humidity during operation	5 to 95%, non-condensing
Mechanical characteristics	
Dimensions	B&R 2005 single-width
Terminal Layout	See 10.4.6 "Pin Assignments", on page 341

Table 203: AI780 technical data (cont.)

1) Refers to the measurement range (0 - 25 mA)
2) Refers to the current measurement value

10.4.4 Status LEDs

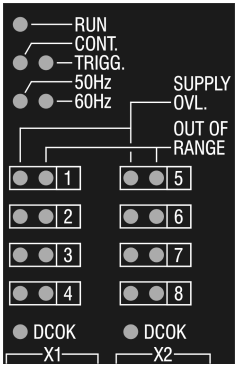
<table>
<tr><th>Figure</th><th>LED</th><th colspan="2">Description</th></tr>
<tr><td rowspan="13"> 
</td><td>RUN</td><td colspan="2">Indicates that the analog/digital converter is running and is being accessed on the module via the I/O bus.</td></tr>
<tr><td>CONT.</td><td colspan="2">Continuous mode is set (standard mode).</td></tr>
<tr><td>TRIGG.</td><td colspan="2">Trigger mode is set. The LED is lit when a measurement cycle is started by a trigger pulse for all eight channels.</td></tr>
<tr><td>50Hz</td><td colspan="2">The filter time is 20 ms.</td></tr>
<tr><td>60 Hz</td><td colspan="2">The filter time is 16.67 ms.</td></tr>
<tr><td rowspan="4">Supply Overload 1 - 8</td><td colspan="2">Status display for encoder supply. Each channel is assigned one LED.</td></tr>
<tr><td>Status</td><td>Description</td></tr>
<tr><td>Constant light</td><td>An over-current or a short circuit has occurred in the respective channel supply.</td></tr>
<tr><td>Blink signal</td><td>A converter error exists or the module supply is too low.</td></tr>
<tr><td rowspan="4">Out of Range 1 - 8</td><td colspan="2">Status display for input range and converter function. Each channel is assigned one LED.</td></tr>
<tr><td>Status</td><td>Description</td></tr>
<tr><td>Constant light</td><td>The input signal for the channel is outside the valid range.</td></tr>
<tr><td>Blink signal</td><td>When the Out of Range LED is blinking, then the converter for this channel is out of service.</td></tr>
<tr><td>Double pulse</td><td>When the LED Out of Range blinks as a double pulse, then the input signal for the channel is outside the valid range and converter for this channel is out of service.</td></tr>
<tr><td>DCOK</td><td colspan="2">The DCOK LED is controlled by the respective module supply and is lit if the supply voltage is over 18 VDC.</td></tr>
</table>

Table 204: AI780 status LEDs

10.4.5 Connection Elements

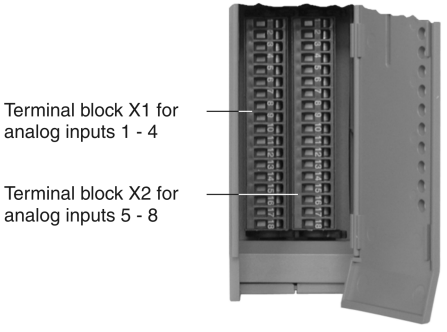


Figure 129: AI780 connection elements

10.4.6 Pin Assignments

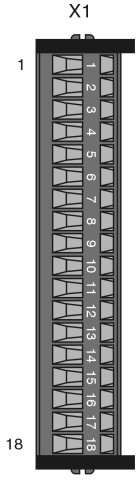
Left 18-pin Terminal Block	Pin	Assignment
	1	+ Encoder supply 1
	2	+ Current input 1
	3	- Current input 1
	4	Free
	5	+ Encoder supply 2
	6	+ Current input 2
	7	- Current input 2
	8	Free
	9	+ Encoder supply 3
	10	+ Current input 3
	11	- Current input 3
	12	Free
	13	+ Encoder supply 4
	14	+ Current input 4
	15	- Current input 4
	16	Free
	17	+24 VDC
	18	GND

Table 205: AI780 pin assignments for terminal block X1

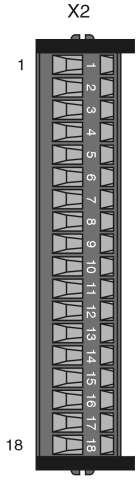
Right 18-pin Terminal Block	Pin	Assignment
 TB718	1	+ Encoder supply 5
	2	+ Current input 5
	3	- Current input 5
	4	Free
	5	+ Encoder supply 6
	6	+ Current input 6
	7	- Current input 6
	8	Free
	9	+ Encoder supply 7
	10	+ Current input 7
	11	- Current input 7
	12	Free
	13	+ Encoder supply 8
	14	+ Current input 8
	15	- Current input 8
	16	Free
	17	+24 VDC
	18	GND

Table 206: AI780 pin assignment for terminal block X2

10.4.7 Connection Examples

Encoder Connection with External Supply

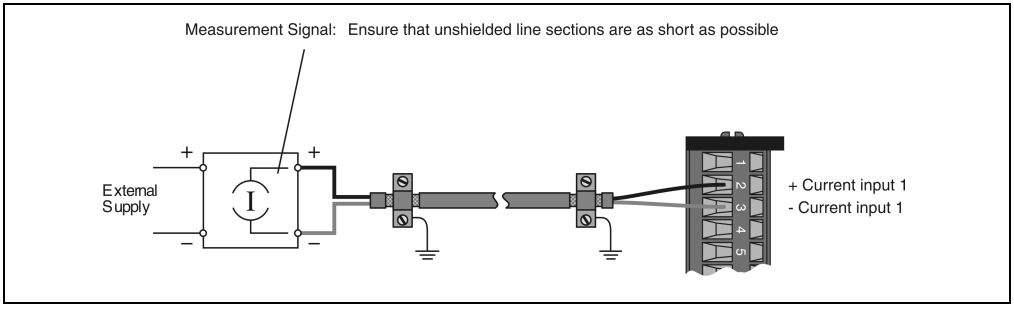


Figure 130: AI780 encoder connection with external supply

Encoder Connection with Internal Supply

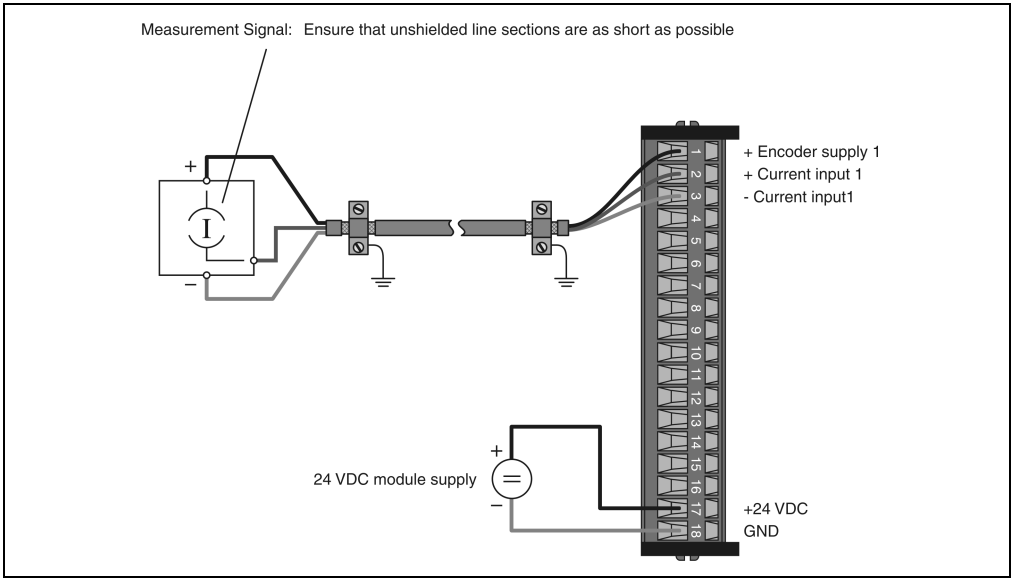


Figure 131: AI780 encoder connection with internal supply

Two Wire Connection with Supply via AI780

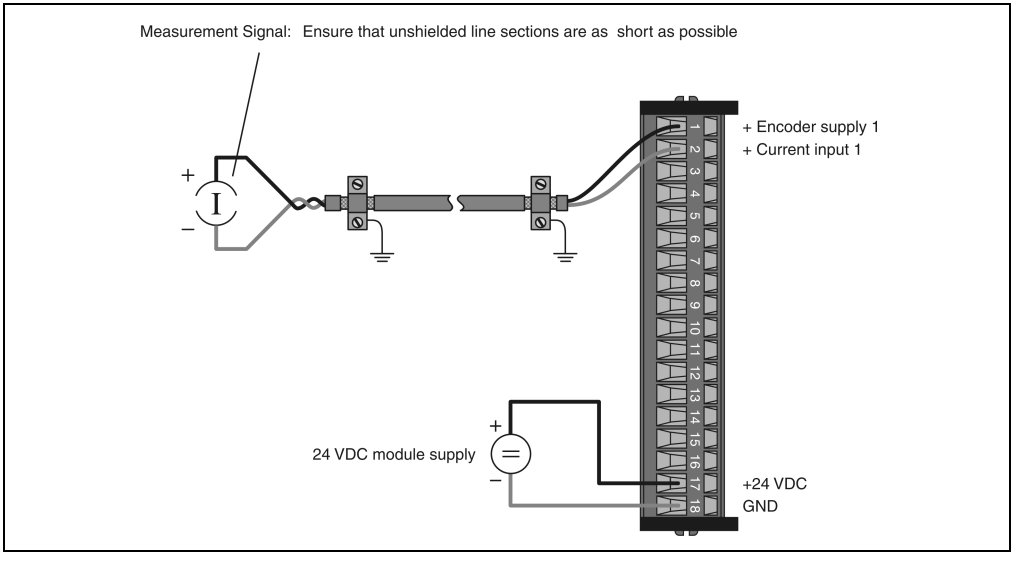


Figure 132: AI780 two wire connection with supply via AI780

10.4.8 Input Circuit Diagram

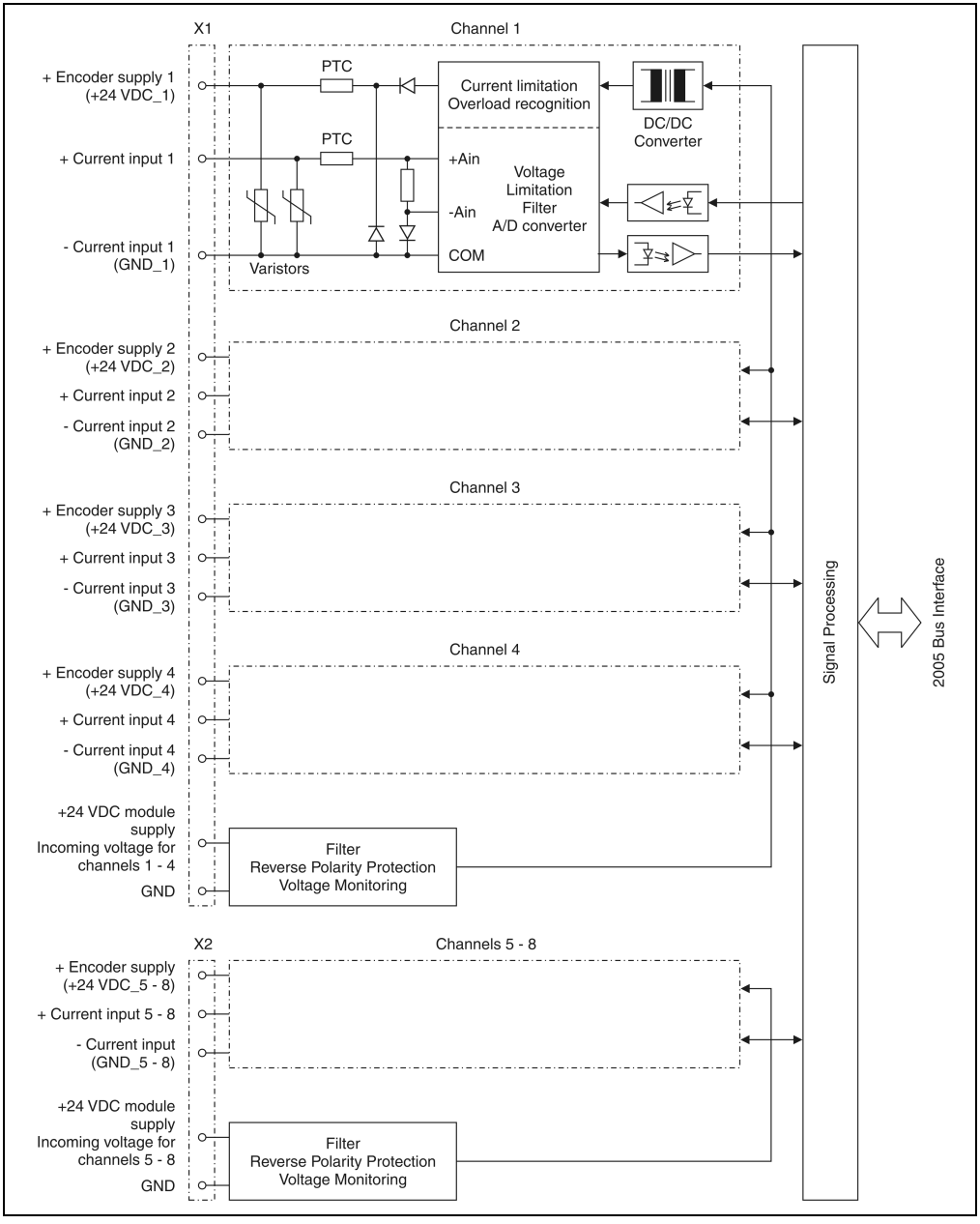


Figure 133: AI780 input circuit diagram

10.4.9 Derating

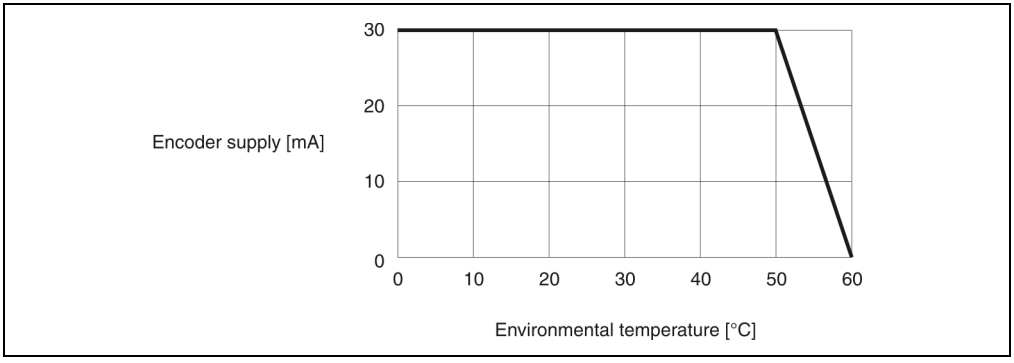


Figure 134: AI780 derating

10.4.10 Operating Modes

Two operating modes can be configured for the AI780. The configured operating mode is valid for all eight channels.

Continuous Mode

The continuous mode is also known as the standard mode. In this mode, the AI780 is found after power-on. The analog/digital converters run asynchronous to one another and convert the respective channel as fast as possible.

Trigger Mode

The trigger mode is configured by setting bit 0 in the configuration register. The analog/digital converter for a measurement cycle are activated using a trigger pulse. For the remainder of the time, they are stopped.

10.4.11 Standardization

The input signal is converted to a raw value by the analog/digital converter. A measurement value is calculated from this raw value, which is then made available to the user for his program.

The operating system for the AI780 offers the possibility of standardization. Therefore the measurement value is calculated in a defined physical unit by the user.

10.4.12 Variable Declarations

B&R Automation Studio™ Support: See B&R Automation Studio™ Help starting with V1.40

Function	Variable Declarations				
	Scope	Data Type	Length	Module Type	Chan.
Read single analog input (channel x) Depending on the configuation, the measurement value or the standardized measurement value is read.	tc_global	INT	1	Analog In	1 ... 8
Lower limit values were exceeded	tc_global	USINT	1	Status In	0
Upper limit values exceeded	tc_global	USINT	1	Status In	1
Read converter function register	tc_global	USINT	1	Status In	2
Read supply overload register	tc_global	USINT	1	Status In	3
Read module status	tc_global	USINT	1	Status In	6
Sends trigger pulse by setting bit 7	tc_global	USINT	1	Transparent Out	0
Configure module	tc_global	USINT	1	Transparent Out	1
Switches standardization on or off. The following settings are accepted using the positive edge when switching on the standardization: • All settings in the data module (see section "Data for the Standardization", on page 353) • The variable "Standardization using Coordinates or Slope and Offset" • The variable "Standardization absolute/relative"	tc_global	USINT	1	Transparent Out	3
Standardization using two coordinates (x0/y0) and (x1/y1) or using slope k and offset d.	tc_global	USINT	1	Transparent Out	4
Standardization absolute/relative (see section "Absolute or relative standardization", on page 354).	tc_global	USINT	1	Transparent Out	5

Table 207: AI780 variable declaration Data Area

Lower Limit Values were Exceeded (read)

Lower limit values are defined in the data module (default: $8001). The data module is described in section "Data for the Standardization", on page 353.

Bit	Description
0	0 ... signal from channel 1 is in the valid range 1 ... Signal from channel 1 is below the limit value
1	0 ... signal from channel 2 is in the valid range 1 ... Signal from channel 2 is below the limit value
2	0 ... Signal from channel 3 is in the valid range 1 ... Signal from channel 3 is below the limit value
3	0 ... signal from channel 4 is in the valid range 1 ... Signal from channel 4 is below the limit value
4	0 ... Signal from channel 5 is in the valid range 1 ... Signal from channel 5 is below the limit value
5	0 ... signal from channel 6 is in the valid range 1 ... Signal from channel 6 is below the limit value
6	0 ... Signal from channel 7 is in the valid range 1 ... Signal from channel 7 is below the limit value
7	0 ... signal from channel 8 is in the valid range 1 ... Signal from channel 8 is below the limit value

Upper Limit Values Exceeded (read)

The upper limit value is defined in the data module (default: $7FFF). The data module is described in section "Data for the Standardization", on page 353.

Bit	Description
0	0 ... signal from channel 1 is in the valid range 1 ... Signal from channel 1 is above the limit value
1	0 ... signal from channel 2 is in the valid range 1 ... Signal from channel 2 is above the limit value
2	0 ... Signal from channel 3 is in the valid range 1 ... Signal from channel 3 is above the limit value
3	0 ... signal from channel 4 is in the valid range 1 ... Signal from channel 4 is above the limit value
4	0 ... Signal from channel 5 is in the valid range 1 ... Signal from channel 5 is above the limit value
5	0 ... signal from channel 6 is in the valid range 1 ... Signal from channel 6 is above the limit value
6	0 ... Signal from channel 7 is in the valid range 1 ... Signal from channel 7 is above the limit value
7	0 ... signal from channel 8 is in the valid range 1 ... Signal from channel 8 is above the limit value

Converter Function Register (read)

Bit	Description
0	0 ... Converter for channel 1 is running 1 ... Converter for channel 1 is out of service [1)]
1	0 ... Converter for channel 2 is running 1 ... Converter for channel 2 is out of service [1)]
2	0 ... Converter for channel 3 is running 1 ... Converter for channel 3 is out of service [1)]
3	0 ... Converter for channel 4 is running 1 ... Converter for channel 4 is out of service [1)]
4	0 ... Converter for channel 5 is running 1 ... Converter for channel 5 is out of service [1)]
5	0 ... converter for channel 6 is running 1 ... Converter for channel 6 is out of service [1)]
6	0 ... Converter for channel 7 is running 1 ... Converter for channel 7 is out of service [1)]
7	0 ... Converter for channel 8 is running 1 ... Converter for channel 8 is out of service [1)]

1) The converter can be out of service either because of a disturbance or because the 24 VDC industrial voltage to terminal blocks X1 and X2 is missing (Pin 17 and 18).

Supply Overload Register (read)

Bit	Description
0	0 ... Encoder supply for channel 1 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 1.
1	0 ... encoder supply for channel 2 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 2.
2	0 ... Encoder supply for channel 3 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 3.
3	0 ... encoder supply for channel 4 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 4.
4	0 ... Encoder supply for channel 5 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 5.
5	0 ... encoder supply for channel 6 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 6.
6	0 ... Encoder supply for channel 7 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 7.
7	0 ... encoder supply for channel 8 is in the valid range 1 ...An over-current or a short circuit has occurred in the encoder supply for channel 8.

Status Register (read)

Bit	Description
0	0 ... Continuous Mode 1 ... Trigger Mode
1	0
2	0 ... Filter 50 Hz (20 ms measurement cycle) 1 ... Filter 60 Hz (16.67 ms measurement cycle)
3	0
4	0 ... The errors are displayed in the status registers and also in the measurement value. $7FFF ... Overflow $8001 .... Underflow $8000 .... Converter is out of service 1 ... The errors are only displayed in the corresponding status register (overflow, underflow, converter is out of service)
5	This bit has only one function, if bit 4 is set in the configuration register (errors are only displayed in the corresponding status register). 0 ... The measurement values are not limited 1 ... The measurement values are limited downwards with the lower limit value and upwards with the upper limit value.
6	0 ... The measurement values correspond to the definitions. 1 ... A system error exists. This means that the measurement values do not correspond to the definitions. Please contact B&R if this occurs.
7	0 ... Measurement is running 1 ... Measurement completed. The bit is set differently depending on the operating mode: Continuous Mode ... after the first measurement Trigger Mode ..... after each measurement

Trigger Pulse (write)

Bit	Description
0 - 6	0
7	0 ... Measurement is not triggered 1 ... Measurement is triggered

Configuration Register (write)

Bit	Description
0	0 ... Continuous Mode (default setting) 1 ... Trigger Mode
1	0
2	0 ... Filter 50 Hz (20 ms measurement cycle) (default setting) 1 ... Filter 60 Hz (16.67 ms measurement cycle)
3	0
4	0 ... The errors are additionally displayed in the status registers also in the measurement value (default setting). $7FFF ... Overflow $8001 .... Underflow $8000 .... Converter is out of service 1 ... The errors are only displayed in the corresponding status register (overflow, underflow, converter is out of service)
5	This bit has only one function, if bit 4 is set in the configuration register (errors are only displayed in the corresponding status register). 0 ... The measurement values are not limited (default setting) 1 ... The measurement values are limited downwards with the lower limit value and upwards with the upper limit value.
6 - 7	0

Switches Standardization On / Off (write)

Bit	Description
0	0 ... Channel 1 is not standardized 1 ... Channel 1 is standardized
1	0 ... Channel 2 is not standardized 1 ... Channel 2 is standardized
2	0 ... Channel 3 is not standardized 1 ... Channel 3 is standardized
3	0 ... Channel 4 is not standardized 1 ... Channel 4 is standardized
4	0 ... Channel 5 is not standardized 1 ... Channel 5 is standardized
5	0 ... Channel 6 is not standardized 1 ... Channel 6 is standardized
6	0 ... Channel 7 is not standardized 1 ... Channel 7 is standardized
7	0 ... Channel 8 is not standardized 1 ... Channel 8 is standardized

Standardization using Two Coordinates or using Slope and Offset (write)

Bit	Description
0	0 ... Channel 1: Standardization using two coordinates 1 ... Channel 1: Standardization using slope and offset
1	0 ... Channel 2: Standardization using two coordinates 1 ... Channel 2: Standardization using slope and offset
2	0 ... Channel 3: Standardization using two coordinates 1 ... Channel 3: Standardization using slope and offset
3	0 ... Channel 4: Standardization using two coordinates 1 ... Channel 4: Standardization using slope and offset
4	0 ... Channel 5: Standardization using two coordinates 1 ... Channel 5: Standardization using slope and offset
5	0 ... Channel 6: Standardization using two coordinates 1 ... Channel 6: Standardization using slope and offset
6	0 ... Channel 7: Standardization using two coordinates 1 ... Channel 7: Standardization using slope and offset
7	0 ... Channel 8: Standardization using two coordinates 1 ... Channel 8: Standardization using slope and offset

Standardization Absolute/Relative (write)

Bit	Description
0	0 ... Channel 1: Absolute standardization 1 ... Channel 1: Relative standardization
1	0 ... Channel 2: Absolute standardization 1 ... Channel 2: Relative standardization
2	0 ... Channel 3: Absolute standardization 1 ... Channel 3: Relative standardization
3	0 ... Channel 4: Absolute standardization 1 ... Channel 4: Relative standardization
4	0 ... Channel 5: Absolute standardization 1 ... Channel 5: Relative standardization
5	0 ... Channel 6: Absolute standardization 1 ... Channel 6: Relative standardization
6	0 ... Channel 7: Absolute standardization 1 ... Channel 7: Relative standardization
7	0 ... Channel 8: Absolute standardization 1 ... Channel 8: Relative standardization

10.4.13 Standardization

General Information

Through standardization, the measurement value is assigned a value corresponding to the physical unit. The conversion takes place along a standardization line:

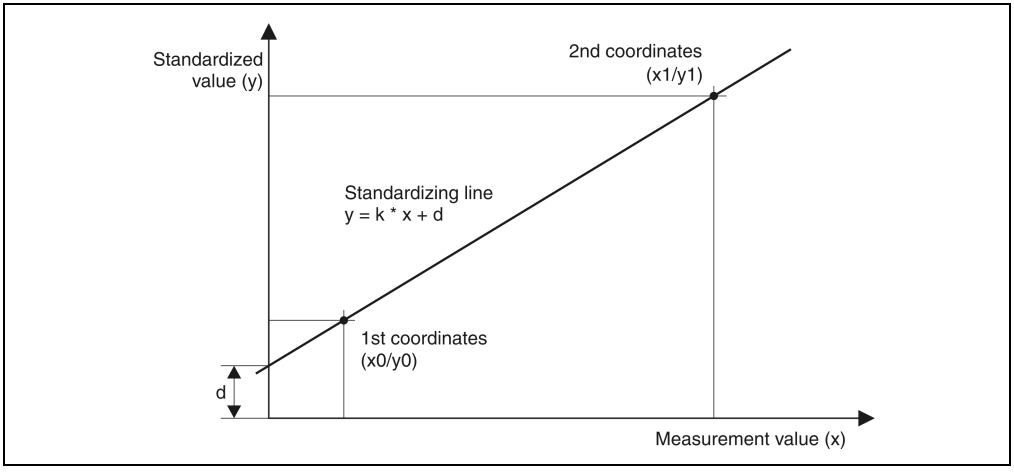


Figure 135: AI780 standardization

The line equation is: $y = k * x + d$

y ..... standardized value
k ..... slope
x ..... measurement value
d ..... y, if x = 0 (offset)

Definition for the Standardizing Line

The definition can be made in two ways:

- Using two coordinates
- Using slope k and offset d

Definition for Equations using Two Coordinates

If the slope and the offset for the line equation is unknown, then the standardization line must be defined using two coordinates (x0/y0) and (x1/y1).

Standard setting: 0 mA $0000
20 mA ... $7FFF

Defining the Coordinates

The coordinates are defined using corresponding values y0 and y1 for the physical units and using the corresponding values x0 and x1 for the measurement values. The values for y0 and y1 (set value) are known. x0 and x1 (actual value) are defined as follows:

No.	Command to be Executed
1	Create conditions which correspond to the first coordinates (x0/y0) (weight, load etc.). The setting corresponds to the encoder minimum value.
2	Read the measurement value and save.
3	Create conditions which correspond to the second coordinates (x1/y1). The setting corresponds to the encoder maximum value.
4	Read the measurement value and save.

Table 208: Defining the Coordinates

Data for the Standardization

The various configuration data is created in the form of a data module, which is transferred to the module using the Spooler library. The variable "Switching Standardization On/Off" must be set to 0 and then to 1 for the data to be accepted. The data is accepted using the positive edges. The text at the beginning of the data module is used for identification of the module and is not allowed to be changed or moved.

The data module is created/configured using B&R Automation Studio™ in offline mode and then transferred to the PLC.

The library DataObj is available for manipulation during the operation of the system. Value changes can be made e.g. using the visualization device.

In section 10.4.15 "Configuration Examples" two data modules are listed.

Definition of the Straight Lines using Slope and Offset

If the slope k and the offset d for the line equation is known, then the definition for the standardizing lines can be made using these two parameters.

Standard setting: 0 mA $00000000
20 mA ... $00010000

Number Format

The number format for k and d is DINT. The 2 high-order bytes are the integer part and the 2 low-order bytes are the decimal places. To ensure the correct processing, both values must be multiplied by 65536.

Example: k = 2.4 and d = 0.5

Slope = k x 65536 = 2.4 x 65536 = 157286 = $00026666
Offset = d x 65536 = 0.5 x 65536 = 32768 = $00008000

Special Functions

- Other standardization parameters can be configured for each channel
- Standardization can be switched on or off separately for each channel
- Standardization can be made absolute or relative for each channel

Absolute or relative standardization

1) Absolute standardization

Normally, absolute standardization is used. The slope k and the offset d are taken directly from the operating system for the AI780 and calculated from the coordinates provided.

2) Relative standardization

The relative standardization can e.g. be used during commissioning or for matching a line equation to modified operating conditions.

With relative standardization, the AI780 records the current values for the slope and the offset when switching off. The parameters for k and d transferred during the boot phase are not directly accepted, rather used as factor. The new slope and the new offset are calculated using these factors:

$$k_{new} = k_{old} \times k_{factor}$$

$$d_{new} = d_{old} \times k_{factor} + d_{factor}$$

10.4.14 Commissioning

1) Creating the data module. The data module is created offline using B&R Automation Studio™ and in the operation using the library DataObj. The following data is defined:

   - Lower/upper limit value
   - Coordinates
   - Slope k and Offset d

   If the data module was created using B&R Automation Studio™, then the data module must be transferred to the PLC.

2) Spool the data module onto the AI780 using the Spooler library.

3) Define whether standardization should be made using two coordinates or using slope k and offset d.

4) Define whether standardization is made absolute or relative.

5) Switch standardization on/off. Switching on standardization is interpreted as the start signal for the converters. Converters are operated differently, depending on the operating mode:

Continuous Mode:	Converters are started
Trigger Mode:	Converters can be started using a trigger pulse for one measurement cycle at a time

10.4.15 Configuration Examples

Example 1 - Standard setting

The standard settings are described in the following example. The measurement values are standardized to 0 - 20 mA. Settings for the lower and upper limit values correspond to the respective maximum value.

- Setting the lower limit to $8001
- Setting the upper limit to $7FFF
- All coordinates are 0/0, which means that the x/y calculation is deactivated

Data Module

```
"6098_cfg",0,0,0,0,0,   ; text is not allowed to be changed
$0100,                  ; Version code AI780 configuration structure

$8001,        ; Lower limit channel 1
$8001,        ; Lower limit channel 2
$8001,        ; Lower limit channel 3
$8001,        ; Lower limit channel 4
$8001,        ; Lower limit channel 5
```

```
$8001,        ; Lower limit channel 6
$8001,        ; Lower limit channel 7
$8001,        ; Lower limit channel 8

$7FFF,        ; Upper limit channel 1
$7FFF,        ; Upper limit channel 2
$7FFF,        ; Upper limit channel 3
$7FFF,        ; Upper limit channel 4
$7FFF,        ; Upper limit channel 5
$7FFF,        ; Upper limit channel 6
$7FFF,        ; Upper limit channel 7
$7FFF,        ; Upper limit channel 8

00000,        ; x0 channel 1
00000,        ; x0 channel 2
00000,        ; x0 channel 3
00000,        ; x0 channel 4
00000,        ; x0 channel 5
00000,        ; x0 channel 6
00000,        ; x0 channel 7
00000,        ; x0 channel 8

00000,        ; x1 channel 1
00000,        ; x1 channel 2
00000,        ; x1 channel 3
00000,        ; x1 channel 4
00000,        ; x1 channel 5
00000,        ; x1 channel 6
00000,        ; x1 channel 7
00000,        ; x1 channel 8

00000,        ; y0 channel 1
00000,        ; y0 channel 2
00000,        ; y0 channel 3
00000,        ; y0 channel 4
00000,        ; y0 channel 5
00000,        ; y0 channel 6
00000,        ; y0 channel 7
00000,        ; y0 channel 8

00000,        ; y1 channel 1
00000,        ; y1 channel 2
00000,        ; y1 channel 3
00000,        ; y1 channel 4
00000,        ; y1 channel 5
00000,        ; y1 channel 6
00000,        ; y1 channel 7
00000,        ; y1 channel 8

$00010000,    ; k * 65536 channel 1
$00010000,    ; k * 65536 channel 2
$00010000,    ; k * 65536 channel 3
```

```
$00010000,    ; k * 65536 channel 4
$00010000,    ; k * 65536 channel 5
$00010000,    ; k * 65536 channel 6
$00010000,    ; k * 65536 channel 7
$00010000,    ; k * 65536 channel 8

$00000000,    ; d * 65536 channel 1
$00000000,    ; d * 65536 channel 2
$00000000,    ; d * 65536 channel 3
$00000000,    ; d * 65536 channel 4
$00000000,    ; d * 65536 channel 5
$00000000,    ; d * 65536 channel 6
$00000000,    ; d * 65536 channel 7
$00000000,    ; d * 65536 channel 8
```

Example 2

The measurement values are standardized to auf 4 - 20 mA in the following example. Additionally, the data for the lower and upper limit values were changed.

- Setting the lower limit to 0
- Setting the upper limit to $7FF0
- The x/y coordinates correspond to measurement value standardization to 4 - 20 mA
- The k/d coordinates correspond to measurement value standardization to 4 - 20 mA

Data Module

```
"6098_cfg",0,0,0,0,0,   ; text is not allowed to be changed
$0100,                  ; Version code AI780 configuration structure

$0000,        ; Lower limit channel 1
$0000,        ; Lower limit channel 2
$0000,        ; Lower limit channel 3
$0000,        ; Lower limit channel 4
$0000,        ; Lower limit channel 5
$0000,        ; Lower limit channel 6
$0000,        ; Lower limit channel 7
$0000,        ; Lower limit channel 8

$7FF0,        ; Upper limit channel 1
$7FF0,        ; Upper limit channel 2
$7FF0,        ; Upper limit channel 3
$7FF0,        ; Upper limit channel 4
$7FF0,        ; Upper limit channel 5
$7FF0,        ; Upper limit channel 6
$7FF0,        ; Upper limit channel 7
$7FF0,        ; Upper limit channel 8

$1999,        ; x0 channel 1
```

```
$1999,        ; x0 channel 2
$1999,        ; x0 channel 3
$1999,        ; x0 channel 4
$1999,        ; x0 channel 5
$1999,        ; x0 channel 6
$1999,        ; x0 channel 7
$1999,        ; x0 channel 8

$7FFF,        ; x1 channel 1
$7FFF,        ; x1 channel 2
$7FFF,        ; x1 channel 3
$7FFF,        ; x1 channel 4
$7FFF,        ; x1 channel 5
$7FFF,        ; x1 channel 6
$7FFF,        ; x1 channel 7
$7FFF,        ; x1 channel 8

$0000,        ; y0 channel 1
$0000,        ; y0 channel 2
$0000,        ; y0 channel 3
$0000,        ; y0 channel 4
$0000,        ; y0 channel 5
$0000,        ; y0 channel 6
$0000,        ; y0 channel 7
$0000,        ; y0 channel 8

$7FFF,        ; y1 channel 1
$7FFF,        ; y1 channel 2
$7FFF,        ; y1 channel 3
$7FFF,        ; y1 channel 4
$7FFF,        ; y1 channel 5
$7FFF,        ; y1 channel 6
$7FFF,        ; y1 channel 7
$7FFF,        ; y1 channel 8

$00014000,    ; k * 65536 channel 1
$00014000,    ; k * 65536 channel 2
$00014000,    ; k * 65536 channel 3
$00014000,    ; k * 65536 channel 4
$00014000,    ; k * 65536 channel 5
$00014000,    ; k * 65536 channel 6
$00014000,    ; k * 65536 channel 7
$00014000,    ; k * 65536 channel 8

$E0004000,    ; d * 65536 channel 1
$E0004000,    ; d * 65536 channel 2
$E0004000,    ; d * 65536 channel 3
$E0004000,    ; d * 65536 channel 4
$E0004000,    ; d * 65536 channel 5
$E0004000,    ; d * 65536 channel 6
$E0004000,    ; d * 65536 channel 7
$E0004000,    ; d * 65536 channel 8
```

Program Example

This program example describes a possible variant for spooling the data module to the AI780. For more details, please consult the online help for the Spooler library in B&R Automation Studio.

```
if (enable_cfg)                    /* Spool configuration to AI780? */
{
  if (DldDataM.enable == 0)        /* first cycle? */
  {
    DldDataM.io_type    = 1;       /* 2005 IO */
    DldDataM.master_no  = 1;       /* always 1 */
    DldDataM.slave_no   = 0;       /* always 0 */
    DldDataM.module_adr = 4;       /* Slot for the AI780 */
    DldDataM.mode       = 0x00;    /* always 0 */
    DldDataM.pName      = (UDINT)"6098_cfg";  /* Name of the configuration module
*/
    DldDataM.enable     = 1;       /* was first cycle */
  }
  SPDownModule(&DldDataM);         /* Calls function block cyclically */
  if (DldDataM.status != 6666)
  {
    Status = DldDataM.status;  /* FBK ready with or without error, see status */
    DldDataM.enable = enable_cfg = 0;
  }
}
```

After the data module has been spooled to the AI780, the variable "Switching Standardization On/Off" must be set to 0 and then to 1 for the data to be accepted. The data is accepted using the positive edges.