1. AI780

1.1 General

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.

1.2 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!	
7TB718.9	Accessory terminal block, 18-pin, screw clamp, 1.5 mm²	
7TB718.91	Accessory terminal block, 18-pin, cage clamp, 1.5 mm²	

Table 1: AI780 - Order data

1.3 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 2: 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 Above upper limit Below lower limit	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
Load Rev. <E0 Rev. ≥E0	 Max. 400 Ω Max. 250 Ω
Zero error at 25°C	±0.005% 1)
Basic accuracy at 25°C	±0.05% 1)
Offset drift	±0.001%/°C1)
Gain drift	±0.007%/°C2)
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 (can be adjusted) by the user using application software
Measurement ranges	0 - 25 mA @ 16-bit converter resolution

Table 2: AI780 - Technical data (cont.)

Product ID	AI780
Wiring	See section 1.7 "Connection examples" on page 6
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 1.10 "Operating modes" on page 9 continuous mode (Standard Mode) Trigger mode
Calibrating or testing for maintaining the accuracy class	None
Non-linearity	<0.003% [1]
Operational conditions	
Ambient temperature during operation	0 to +60° C (see also section 1.9 "Derating" on page 9)
Relative humidity during operation	5 to 95%, non-condensing
Storage Conditions	
Storage temperature	-25 to +70 °C
Relative humidity during storage	5 to 95%, non-condensing
Mechanical characteristics	
Dimensions	B&R 2005 single-width
Terminal layout	See section 1.6 "Pin assignments" on page 5.

Table 2: AI780 - Technical data (cont.)

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

1.4 Status LEDs

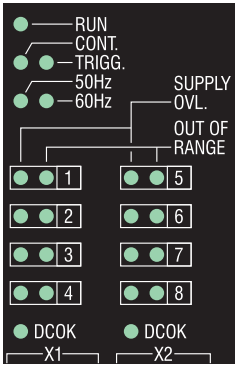
<table>
<tr><th>Figure</th><th>LED</th><th colspan="2">Description</th></tr>
<tr><td rowspan="15"> 
</td><td>RUN</td><td colspan="2">Indicates that the analog/digital converter is running and is being accessed on the module via the I/O bus.</td></tr>
<tr><td>CONT.</td><td colspan="2">Continuous mode 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>60Hz</td><td colspan="2">The filter time is 16.67 ms.</td></tr>
<tr><td rowspan="3">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 rowspan="4">Out of range 1 - 8</td><td>Blink signal</td><td>A converter error exists or the module supply is too low.</td></tr>
<tr><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 Out of Range LED 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 3: AI780 - Status LEDs

1.5 Connection elements

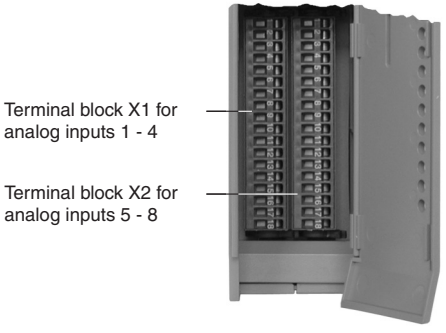


Figure 1: AI780 - Connection elements

1.6 Pin assignments

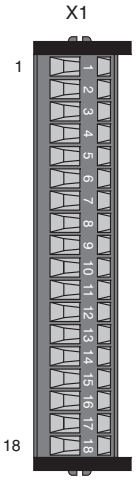
Left 18-Pin Terminal Block	Pin	Assignment
	1	+ Encoder supply 1
	2	+ Current input 1
	3	- Current input 1
	4	Free
	5	+ Encoder supply 2
	6	+ Current input 2
	7	- Current input 2
	8	Free
	9	+ Encoder supply 3
	10	+ Current input 3
	11	- Current input 3
	12	Free
	13	+ Encoder supply 4
	14	+ Current input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

Table 4: AI780 - Pin assignments - Terminal block X1

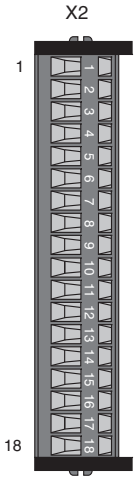
Right 18-Pin Terminal Block	Pin	Assignment
	1	+ Encoder supply 5
	2	+ Current input 5
	3	- Current input 5
	4	Free
	5	+ Encoder supply 6
	6	+ Current input 6
	7	- Current input 6
	8	Free
	9	+ Encoder supply 7
	10	+ Current input 7
	11	- Current input 7
	12	Free
	13	+ Encoder supply 8
	14	+ Current input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

Table 5: AI780 - Pin assignment - Terminal block X2

1.7 Connection examples

1.7.1 Encoder connection with external supply

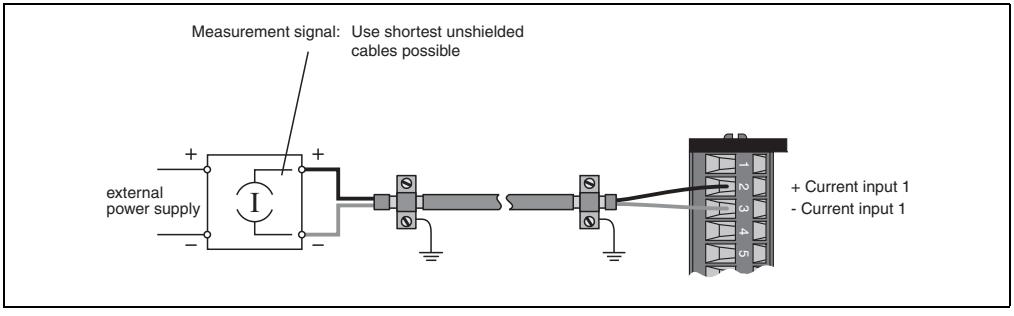


Figure 2: AI780 - Encoder connection - External supply

1.7.2 Encoder connection with internal supply

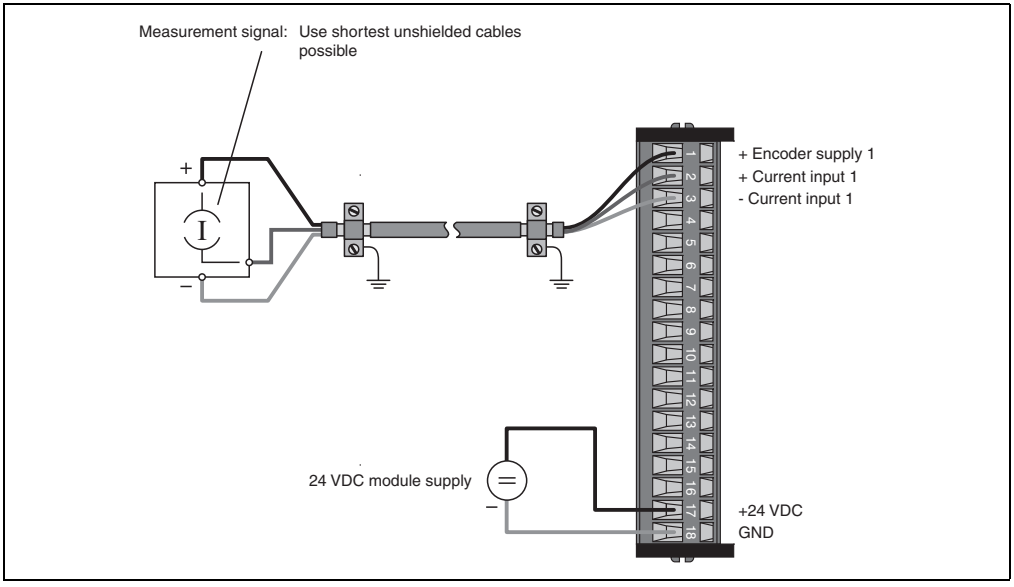


Figure 3: AI780 - Encoder connection - Internal supply

1.7.3 Two wire connection with supply via AI780

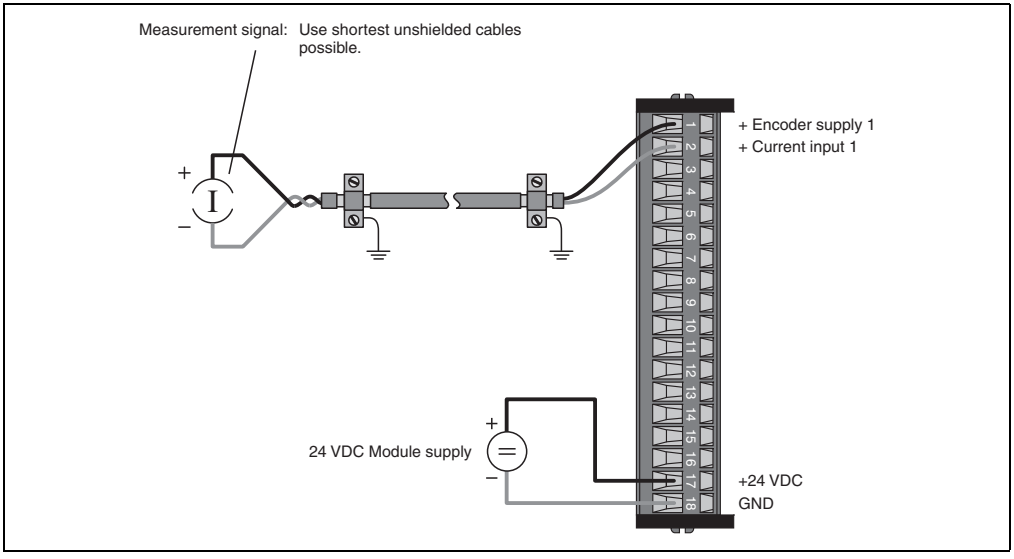


Figure 4: AI780 - Two-wire connection - Supply via AI780

1.8 Input circuit diagram

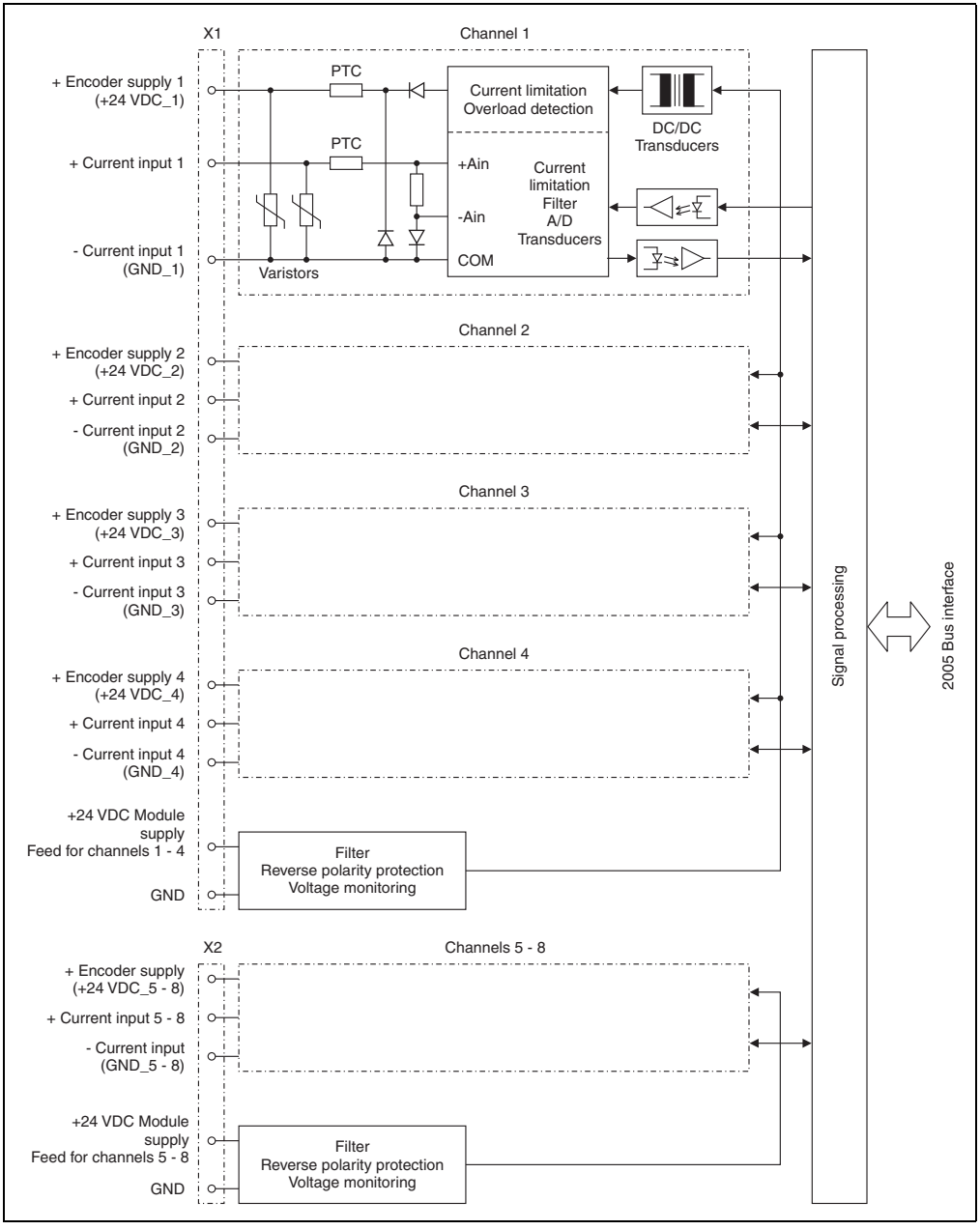


Figure 5: AI780 - Input circuit diagram

1.9 Derating

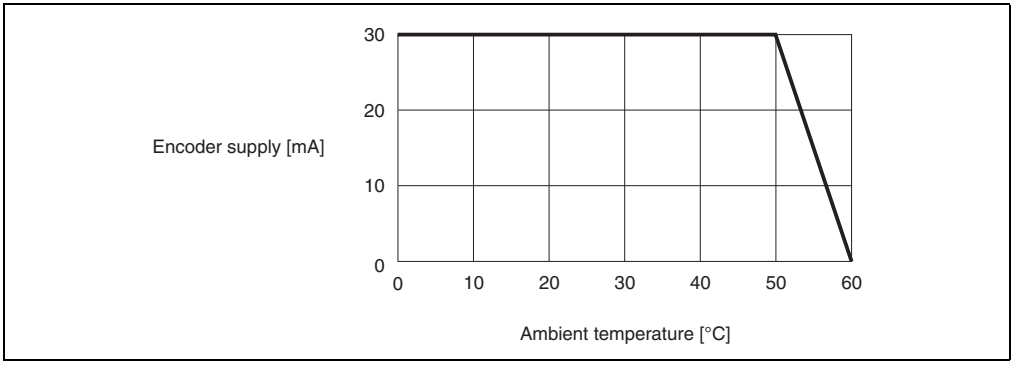


Figure 6: AI780 - Derating

1.10 Operating modes

Two operating modes can be configured for the AI780. The configured operating mode applies to all eight channels.

1.10.1 Continuous mode

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

1.10.2 Trigger mode

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

1.11 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 by the user in a defined physical unit.

1.12 Variable declaration

B&R Automation Studio Support: See B&R Automation Studio Help starting with V 1.40

Function	Variable declaration				
	Scope	Data type	Length	Module type	Channel
Read single analog input (channel x) Depending on the configuration, the measurement value or the standardized measurement value is read.	tc_global	INT	1	Analog In	1 ... 8
Below lower limit value	tc_global	USINT	1	Status In	0
Above upper limit value	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
Switch standardization on / off. The following settings are accepted using the positive edge when switching on the standardization: • All settings in the data object (see section "Data for the standardization" on page 17) • 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 18).	tc_global	USINT	1	Transparent Out	5

Table 6: AI780 - Variable declaration - Data Area

1.12.1 Lower limit values exceeded (read)

Lower limit values are defined in the data object (default: $8001). The data object is described in section "Data for the standardization" on page 17.

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

1.12.2 Upper limit values exceeded (read)

The upper limit value is defined in the data object (default: $7FFF). The data object is described in section "Data for the standardization" on page 17.

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

1.12.3 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).

1.12.4 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.

1.12.5 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 has occurred. 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

1.12.6 Trigger pulse (write)

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

1.12.7 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 displayed in the status registers and 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

1.12.8 Switches standardization on or 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

1.12.9 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

1.12.10 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

1.13 Standardization

1.13.1 General

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

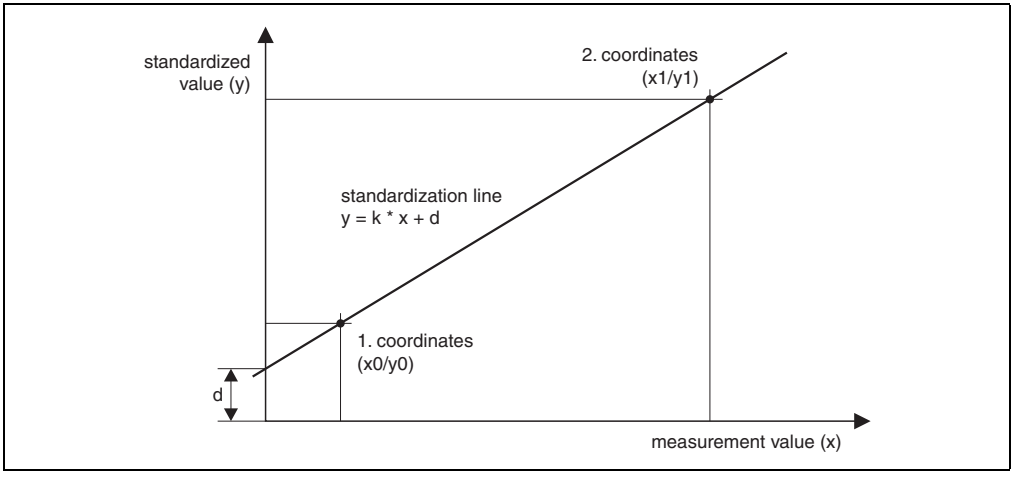


Figure 7: AI780 - Standardization

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

y ..... Standardized value
k ..... Slope
x ..... Measurement value
d ..... y, if x = 0 (offset)

1.13.2 Definition for the standardizing line

The definition can be made in two ways:

- Using two coordinates
- Using slope k and offset d

1.13.3 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 7: Defining the coordinates

Data for the standardization

The various configuration data is created in the form of a data object, 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 applied. The data is applied at the positive edges. The text at the beginning of the data object is used for identification of the module and is not allowed to be changed or moved.

The data object is created/adapted 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 1.15 "Example configurations" two data objects are listed.

1.13.4 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 standardizing lines can be defined using these two parameters.

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

Number format

The format number 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

1.13.5 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 absolute or relative for each channel

1.13.6 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

Relative standardization can be used during commissioning or for matching a line equation to modified operating conditions, for example.

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 applied, rather used as factors. The new slope and the new offset are calculated using these factors:

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

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

1.14 Start-up

1) Create a data object. The data object 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 object was created using B&R Automation Studio, then it must be transferred to the PLC.

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

3) Define whether standardization should use two coordinates or slope k and offset d.

4) Define whether standardization is 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

1.15 Example configurations

1.15.1 Example 1 - Default setting

The default 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 object

```
"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
```

1.15.2 Example 2

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

- Lower limit set to 0
- Upper limit set 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 object

```
"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 method for spooling the data object 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;  /* Fub ready with or without error, see status */
    DldDataM.enable = enable_cfg = 0;
  }
}
```

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