SCHWARZMÜLLER INVERTER

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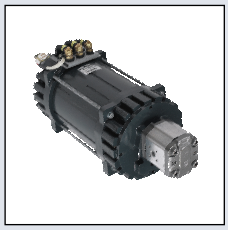
PLUS+1™ Guide

PLUS+1™ Inverter Function Block Library User Manual

70200003



About this manual

This manual describes the function blocks of the Inverter Function Block Library

SD_PLUS+1_Inverter_FB_Library_10108154v102.SDL

The Inverter Function Block Library is a collection of inverter typical function blocks that can be used in any PLUS+1 inverter applications.

The Inverter Function Block Library can be added to GUIDE like any other PLUS+1 Library, for more details please refer to PLUS+1 GUIDE manual.

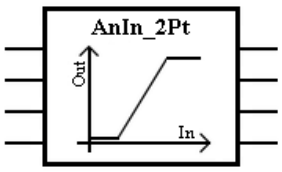
The current version of the Inverter Function Block Library is **V102**, for details on the different released versions please see history at the end of this manual.

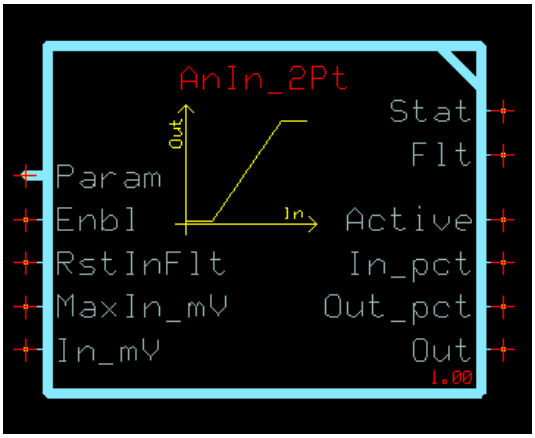
This manual is included in the Library but it is also available from support@schwarzmueller-inverter.com as a separate document under the document number 70200003.

Please Note:
- The library is intended to be compatible with GUIDE version 4.0 and later.
- Some of the function blocks might only work with Schwarzmüller Inverter PLUS+1 Inverter hardware description files (HWD) because of special EEPROM cell handling.

Schwarzmüller Inverter welcomes suggestions for improving our documentation. If you have suggestions for improving this document, please contact Schwarzmüller Inverter at info@schwarzmueller-inverter.com

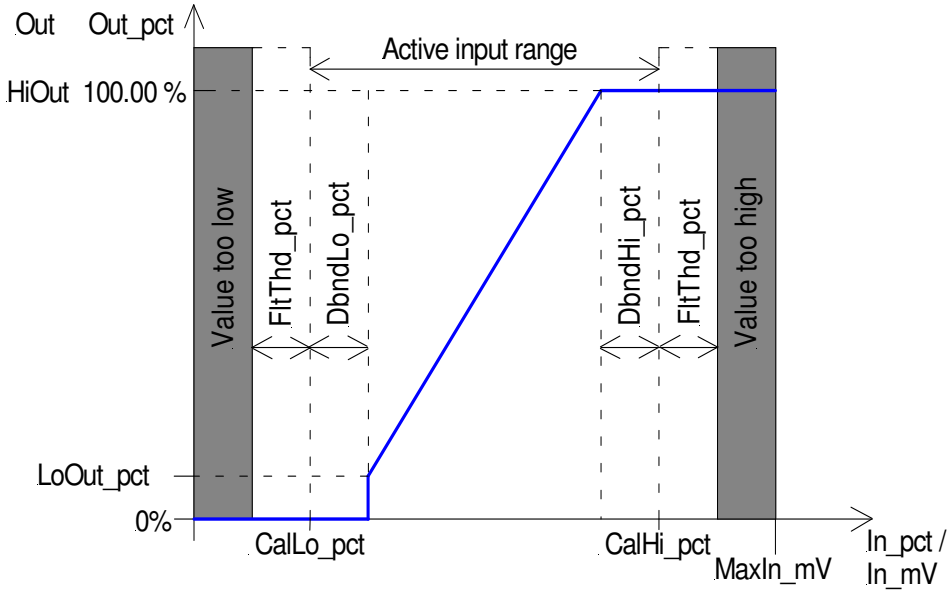
Analog Input Scaling with 2pt line





Function:
The AnIn_2Pt function block can be used for calibrating and scaling an analog input signal with a two point straight line. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also fault detection, dead band and parameter handling functionality.

Diagram:



The active input range is defined by the lower and upper calibration point (*CalLo_pct, CalHi_pct*) as percentages of the maximum input (*MaxIn_mV*).
If required, dead bands can be considered for the calibration points (*DbndLo_pct, DbndHi_pct*).
A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

Calibration

CalLo and *CalHi* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update *CalLo* and *CalHi.*

The two calibration points *CalLo_pct* and *CalHi_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple AnIn_2Pt function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished as outlined above.

Inputs/Outputs

Inputs

Item/Range	Description
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 65000[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32): (0 – 65000[mV])	Analog Input signal in mV
Enbl (BOOL)	Input to enable function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
Active (BOOL)	HIGH if output is not 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV
Out (S32)	Output value scaled to HiOut parameter
Out _pct (U16): (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Inputs/Outputs (continued)

Parameters

Item/Range	Description
CalLo_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 1000)	Low calibration point as percentage of MaxIn_mV.
CalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point as percentage of MaxIn_mV.
LoOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output as percentage of HiOut.
HiOut (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output, 20000 is the maximum input for the DDCG function block
DbndLo_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point as percentage of MaxIn_mV.
DbndHi_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

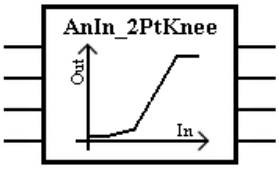
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV)
16	0xX000	Custom/Standard code bit

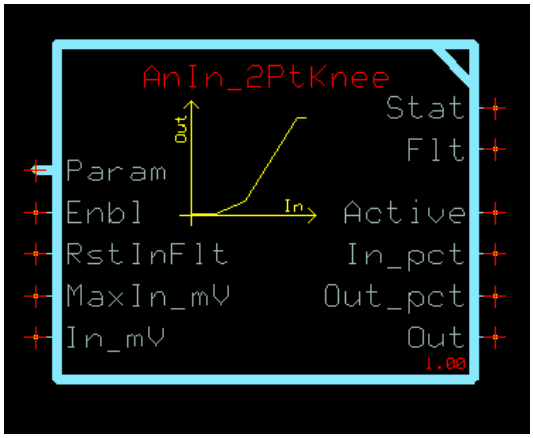
Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

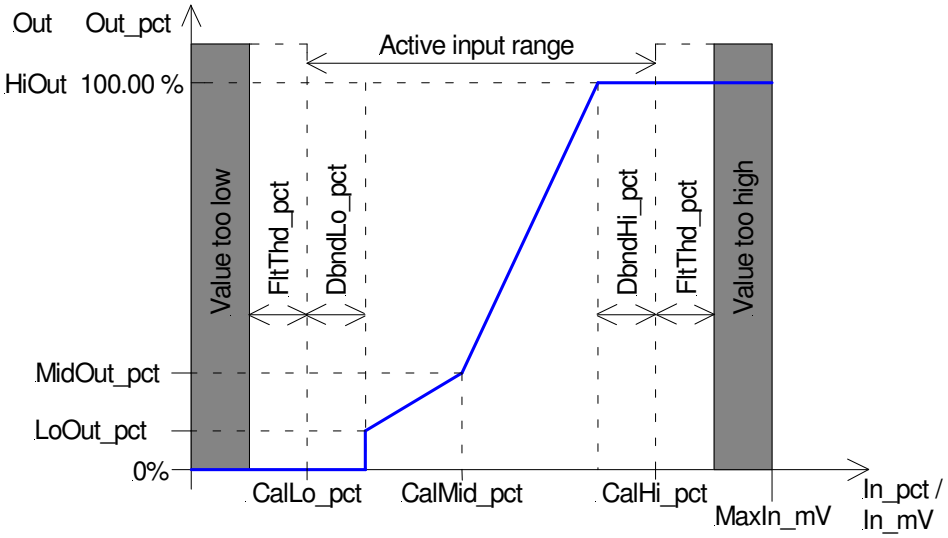
Analog Input Scaling with 2pt line and Knee





Function:
The AnIn_2Pt function block can be used for calibrating and scaling an analog input signal with a two point line. The line can be adjusted to a knee profile. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also fault detection, dead band and parameter handling functionality.

Diagram:



The active input range is defined by the lower and upper calibration point (*CalLo_pct, CalHi_pct*) as percentages of the maximum input (*MaxIn_mV*).
The knee profile is defined by the parameter *CalMid_pct* and *MidOut_pct.*
If required, dead bands can be considered for the calibration points (*DbndLo_pct, DbndHi_pct*).
A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

Calibration

CalLo , *CalMid* and *CalHi* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update *CalLo, CalMid* and *CalHi.*

The three calibration points *CalLo_pct, CalMid* and *CalHi_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple AnIn_2PtKnee function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished by one of the three methods outlined below.

Inputs/Outputs

Inputs

Item/Range	Description
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 6500[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32): (0 – 65000[mV])	Analog Input signal in mV
Enbl (BOOL)	Input to enable function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
Active (BOOL)	HIGH if output is not 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV
Out (S32)	Output value scaled to HiOut parameter
Out _pct (U16): (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Inputs/Outputs (continued)

Parameters

Item/Range	Description
CalLo_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 1000)	Low calibration point as percentage of MaxIn_mV.
CalMid_pct (U16): (0 – 10000 [0,01% of active input range; default value: 5000)	Middle calibration point as percentage of active input range from CalLo_pct to CalHi_pct
CalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point as percentage of MaxIn_mV.
LoOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output as percentage of HiOut.
MidOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated middle value of the output as percentage of HiOut.
HiOut (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output, 20000 is the maximum input for the DDCG function block
DbndLo_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point as percentage of MaxIn_mV.
DbndHi_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

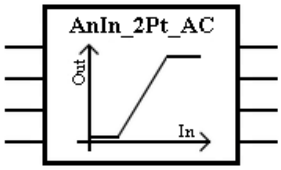
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV)
16	0xX000	Custom/Standard code bit

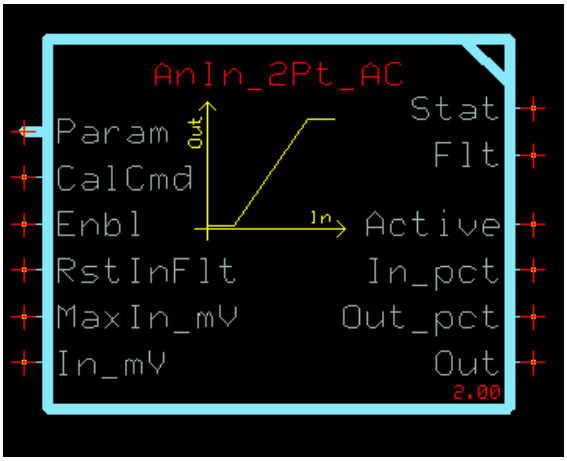
Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

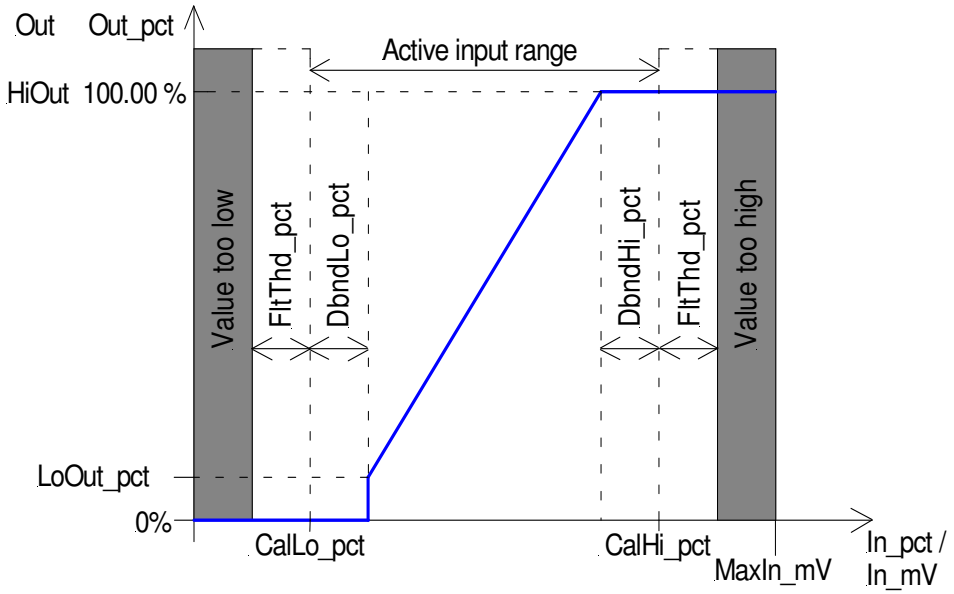
Analog Input Scaling with 2pt line and Auto-Calibration





Function:
The AnIn_2Pt_AC function block can be used for calibrating and scaling an analog input signal with a two point straight line. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also semi-automatic calibration functions, fault detection, dead band and parameter handling functionality.

Diagram:



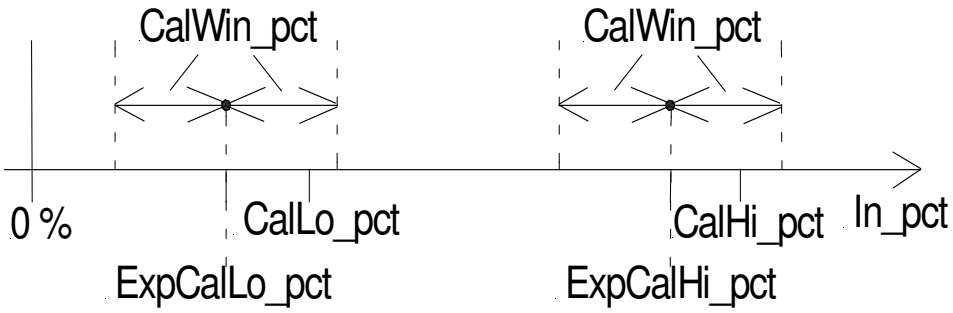
The active input range is defined by the lower and upper calibration point (*CalLo_pct, CalHi_pct*) as percentages of the maximum input (*MaxIn_mV*).
If required, dead bands can be considered for the calibration points (*DbndLo_pct, DbndHi_pct*).
A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

StorCalLo, *StorCalHi* and *SetDef* are outputs intended to control the EE_PROM blocks in the parameters pages.

Calibration



It is highly recommended to start the calibration with the lower calibration point, means HW source of the analog signal is in neutral position when activating the calibration. Otherwise the calibration status message can be wrong, since the block can't distinguish if value "0" for the Lower calibration point is the correct and allowed value or if it's just not calibrated yet.

The two calibration points *CalLo_pct* and *CalHi_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple Sensor_2Pt_AC function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished by one of the three methods outlined below.

Manual Calibration

CalLo and *CalHi* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update *CalLo* and *CalHi.*

Calibration (continued)

Semi-Automatic Calibration

The two calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 1 (Enable Semi-automatic Calibration). As long as the stored values for *CalLo* and *CalHi* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration. The Expected Calibration Points (*ExpCalLo_pct, ExpCalHi_pct*) specify the center of the Calibration Windows. If the input value is within the calibration window for the low or high calibration point for duration *CalDetTm_ms*, the last value is captured and stored for that calibration point. After storing values for both calibration points, semi-automatic calibration is complete. Calibration mode can be activated by either setting the Calibration Command input to 4 or if the stored values of parameters *CalLo_pct* and *CalHi_pct* are zero and the Calibration Command equals 1. *CalLo_pct* and *CalHi_pct* can be set to zero by service tool.

Semi-Automatic Calibration with enable input

The two calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 2 (Enable Semi-automatic Calibration with enable input). As long as the stored values for *CalLo* and *CalHi* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration with Enable Input. The Expected Calibration Points specify the center of the Calibration Windows. If the input value is within the expected window for Low Calibration Point and the Enable Input has a rising edge (0 -> 1) the value is captured and stored. If the input value is within the expected window for High Calibration Point for duration *CalDetTm_ms*, the last value is captured and stored. After storing values for both calibration points, semi-automatic calibration is complete. Calibration Mode can be activated by either setting the Calibration Command Input to 4 or if the stored values of parameters *CalLo_pct* and *CalHi_pct* are zero and if the Calibration Command equals 1. *CalLo_pct* and *CalHi_pct* can be set to zero by service tool.

Set Defaults

If the Calibration Command equals 3, the Set Defaults variable *SetDef* in the parameter bus becomes TRUE. In this case the default values for *CalLo* and *CalHi* will be stored into memory. The default values are constants on input *DEFAULT* of these memory blocks.

Inputs/Outputs

Inputs

Item/Range	Description
Cal Cmd (U8): (0 - 4)	Calibration Command 0: Manual calibration 1: Semi Auto Cal 2: Semi Auto Cal with enable input 3: Set Calibration values to defaults 4: Clear Calibration
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 65000[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32): (0 – 65000[mV])	Analog Input signal in mV
Enbl (BOOL)	Input to enable function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
Active (BOOL)	HIGH if output is not 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV
Out (S32)	Output value scaled to HiOut parameter
Out _pct (U16): (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Inputs/Outputs (continued)

Parameters

Item/Range	Description
StorCalLo (BOOL)	Signal used to store low calibration value
StorCalHi (BOOL)	Signal used to store high calibration value
SetDef (BOOL)	Signal used to set default calibration values
CalLo_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 1000)	Low calibration point as percentage of MaxIn_mV.
CalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point as percentage of MaxIn_mV.
LoOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output as percentage of HiOut.
HiOut (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output, 20000 is the maximum input for the DDCG function block
DbndLo_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point as percentage of MaxIn_mV.
DbndHi_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared
ExpCalLo_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 1000)	Expected value of the lower calibration point, as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
ExpCalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 9000)	Expected value of the upper calibration point as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
CalWin_pct (U16): (0 – 5000 [0,01% of MaxIn_mV]; default value: 500)	Amount +/- expected calibration points used to determine acceptable calibration window. Specified by units of .01% of Snsr Pwr
CalDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Calibration capture time in ms

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

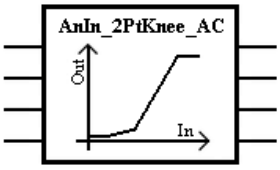
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV) or (CalCmd > 4)
16	0xX000	Custom/Standard code bit

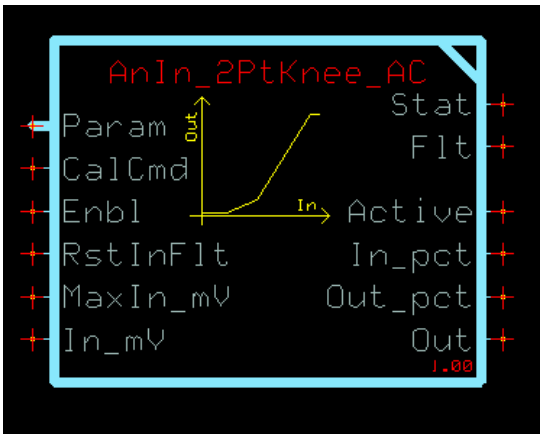
Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

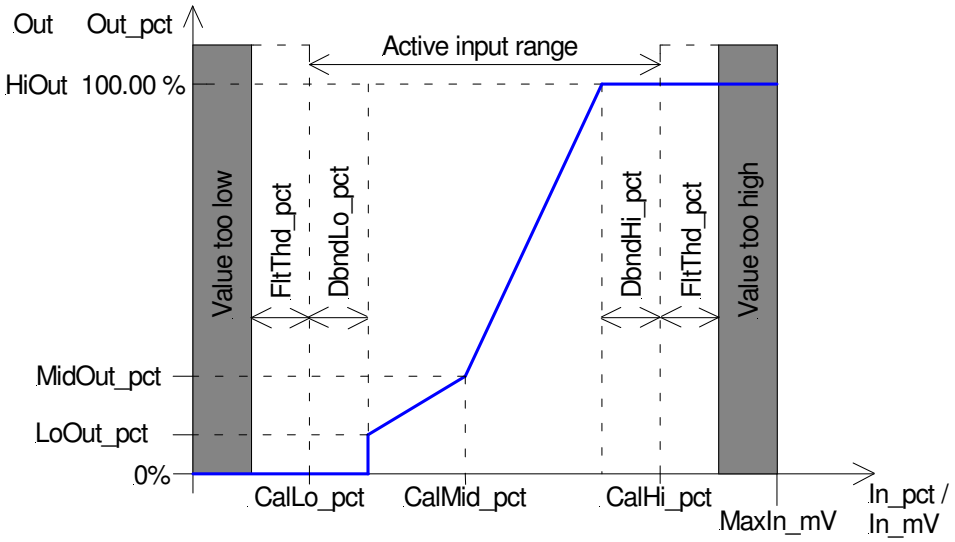
Analog Input Scaling with 2pt line Knee and Auto-Calibration





Function:
The AnIn_2Pt_AC function block can be used for calibrating and scaling an analog input signal with a two point line. The line can be adjusted to a knee profile. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also semi-automatic calibration functions, fault detection, dead band and parameter handling functionality.

Diagram:



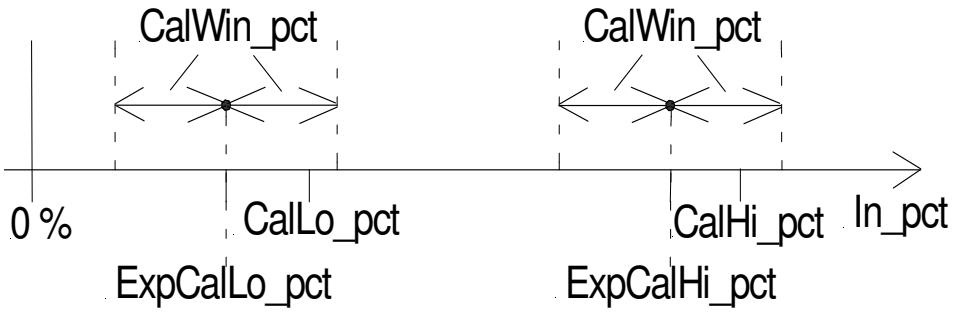
The active input range is defined by the lower and upper calibration point (*CalLo_pct, CalHi_pct*) as percentages of the maximum input (*MaxIn_mV*).
The knee profile is defined by the parameter *CalMid_pct* and *MidOut_pct.*
If required, dead bands can be considered for the calibration points (*DbndLo_pct, DbndHi_pct*).
A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

StorCalLo, *StorCalHi* and *SetDef* are outputs intended to control the EE_PROM blocks in the parameters pages.

Calibration



It is highly recommended to start the calibration with the lower calibration point, means HW source of the analog signal is in neutral position when activating the calibration. Otherwise the calibration status message can be wrong, since the block can't distinguish if value "0" for the Lower calibration point is the correct and allowed value or if it's just not calibrated yet.

The three calibration points *CalLo_pct, CalMid_pct* and *CalHi_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple Sensor_2PtKnee_AC function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished by one of the three methods outlined below.

Manual Calibration

CalLo , *CalMid_pct* and *CalHi* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update *CalLo, CalMid_pct* and *CalHi.*

Calibration (continued)

Semi-Automatic Calibration

The three calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 1 (Enable Semi-automatic Calibration). As long as the stored values for *CalLo* and *CalHi* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration. The Expected Calibration Points (*ExpCalLo_pct, ExpCalHi_pct*) specify the center of the Calibration Windows. If the input value is within the calibration window for the low or high calibration point for duration CalDetTm_ms, the last value is captured and stored for that calibration point. After storing values for both calibration points, semi-automatic calibration is complete. Calibration mode can be activated by either setting the Calibration Command input to 4 or if the stored values of parameters *CalLo_pct* and *CalHi_pct* are zero and the Calibration Command equals 1. *CalLo_pct* and *CalHi_pct* can be set to zero by service tool. *CalMid_pct* can only be set manually.

Semi-Automatic Calibration with enable input

The two calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 2 (Enable Semi-automatic Calibration with enable input). As long as the stored values for *CalLo* and *CalHi* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration with Enable Input. The Expected Calibration Points specify the center of the Calibration Windows. If the input value is within the expected window for Low Calibration Point and the Enable Input has a rising edge (0 -> 1) the value is captured and stored. If the input value is within the expected window for High Calibration Point for duration *CalDetTm_ms*, the last value is captured and stored. After storing values for both calibration points, semi-automatic calibration is complete. Calibration Mode can be activated by either setting the Calibration Command Input to 4 or if the stored values of parameters *CalLo_pct* and *CalHi_pct* are zero and if the Calibration Command equals 1. *CalLo_pct* and *CalHi_pct* can be set to zero by service tool. *CalMid_pct* can only be set manually.

Set Defaults

If the Calibration Command equals 3, the Set Defaults variable *SetDef* in the parameter bus becomes TRUE. In this case the default values for *CalLo* and *CalHi* will be stored into memory. The default values are constants on input *DEFAULT* of these memory blocks.

Inputs/Outputs

Inputs

Item/Range	Description
Cal Cmd (U8): (0 - 4)	Calibration Command 0: Manual calibration 1: Semi Auto Cal 2: Semi Auto Cal with enable input 3: Set Calibration values to defaults 4: Clear Calibration
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 65000[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32): (0 – 65000[mV])	Analog Input signal in mV
Enbl (BOOL)	Input to enable function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
Active (BOOL)	HIGH if output is not 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV
Out (S32)	Output value scaled to HiOut parameter
Out _pct (U16): (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Inputs/Outputs (continued)

Parameters

Item/Range	Description
StorCalLo (BOOL)	Signal used to store low calibration value
StorCalHi (BOOL)	Signal used to store high calibration value
SetDef (BOOL)	Signal used to set default calibration values
CalLo_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; defaultvalue: 1000)	Low calibration point as percentage of MaxIn_mV.
CalMid_pct (U16): (0 – 10000 [0,01% of active input range]; default value: 5000)	Middle calibration point as percentage of active input range from CalLo_pct to CalHi_pct.
CalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point as percentage of MaxIn_mV.
LoOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output as percentage of HiOut.
MidOut_pct (U16): (0-1000 [0,01% of HiOut]; default value: 5000)	Is the calibrated middle value of the output as percentage of HiOut.
HiOut (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output, 20000 is the maximum input for the DDCG function block
DbndLo_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point as percentage of MaxIn_mV.
DbndHi_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared
ExpCalLo_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 1000)	Expected value of the lower calibration point, as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
ExpCalHi_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 9000)	Expected value of the upper calibration point as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
CalWin_pct (U16): (0 – 5000 [0,01% of MaxIn_mV]; default value: 500)	Amount +/- expected calibration points used to determine acceptable calibration window. Specified by units of .01% of Snsr Pwr
CalDetTm_ms (U16) (0 – 10000 [ms]; default value: 1000)	Calibration capture time in ms

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

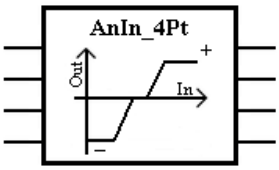
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV) or (CalCmd > 4)
16	0xX000	Custom/Standard code bit

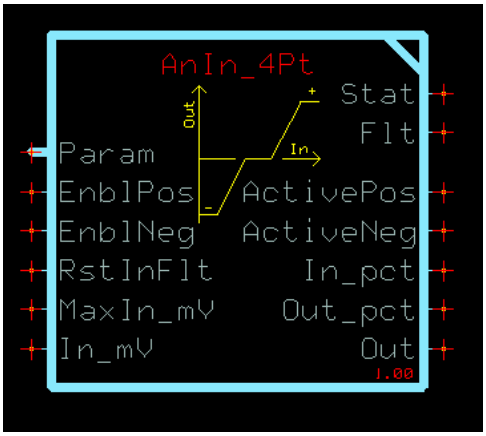
Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

Analog Input Scaling with 4pt line

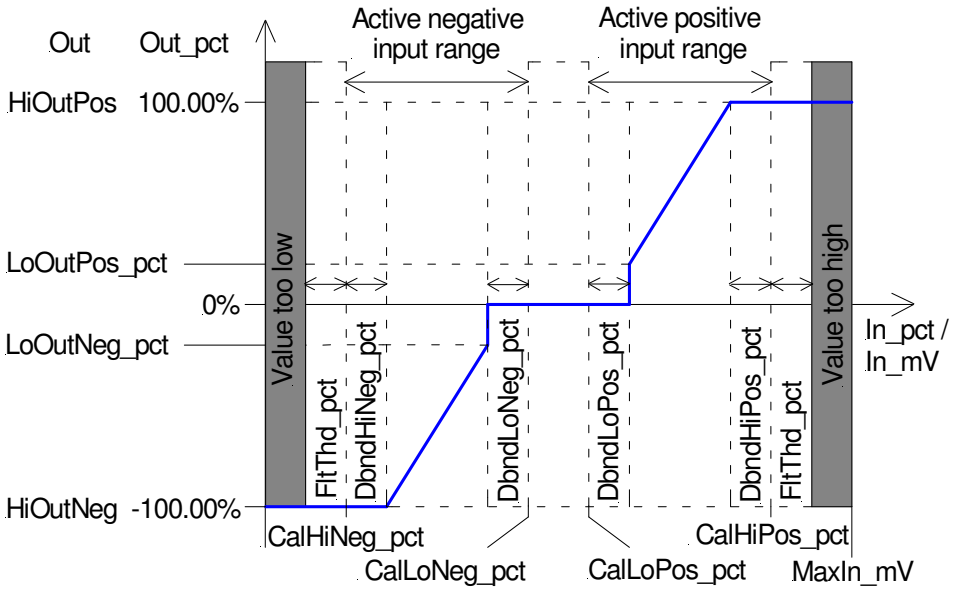




Function:

The AnIn_4Pt function block can be used for calibrating and scaling an analog input signal with a four point line. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also fault detection, dead band and parameter handling functionality.

Diagram:



The active positive input range is defined by the positive lower and upper calibration point (*CalLoPos_pct, CalHiPos_pct*) as percentages of the maximum input (*MaxIn_mV*). The active negative input range is defined by the negative lower and upper calibration point (*CalLoNeg_pct, CalHiNeg_pct*) as percentages of the maximum input (*MaxIn_mV*).
If required, dead bands can be considered for all four calibration points (*DbndLoPos_pct, DbndHiPos_pct, DbndLoNeg_pct, DbndHiNeg_pct*).

A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

Calibration

CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct and *CalHiNeg_pct* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update these parameter.

The four calibration points *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple AnIn_4Pt function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished as outlined above.

Inputs/Outputs

Inputs

Item/Range	Description
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 65000[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32): (0 – 65000[mV])	Analog Input signal in mV
EnblPos (BOOL)	Input to enable the positive part of the function block output
EnblNeg (BOOL)	Input to enable the negative part of the function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
ActivePos (BOOL)	HIGH if output is greater than 0
ActiveNeg (BOOL)	HIGH if output is less than 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV

Inputs/Outputs (continued)

Outputs

Item/Range	Description
Out (S32)	Output value scaled to HiOutPos or HighOutNeg parameter
Out _pct (U16) (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Parameters

Item/Range	Description
CalLoPos_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 5500)	Low calibration point for the positive part as percentage of MaxIn_mV.
CalHiPos_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point for the positive part as percentage of MaxIn_mV.
LoOutPos_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output for the positive part as percentage of HiOut.
HiOutPos (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output for the positive part, 20000 is the maximum input for the DDCG function block
DbndLoPos_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point for the positive part as percentage of MaxIn_mV.
DbndHiPos_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point for the positive part as percentage of MaxIn_mV.
CalLoNeg_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 4500)	Low calibration point for the negative part as percentage of MaxIn_mV.
CalHiNeg_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point for the negative part as percentage of MaxIn_mV.
LoOutNeg_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output for the negative part as percentage of HiOut.
HiOutNeg (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output for the negative part, 20000 is the maximum input for the DDCG function block
DbndLoNeg_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point for the negative part as percentage of MaxIn_mV.
DbndHiNeg_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point for the negative part as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

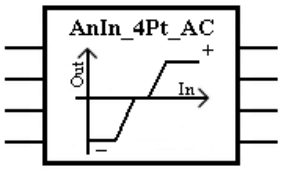
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV)
16	0xX000	Custom/Standard code bit

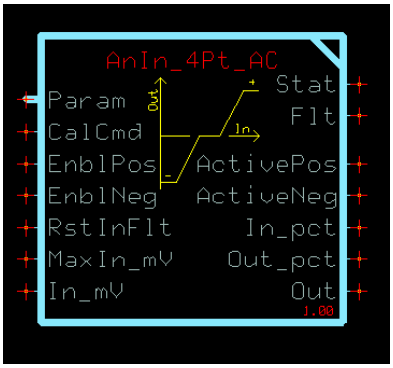
Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

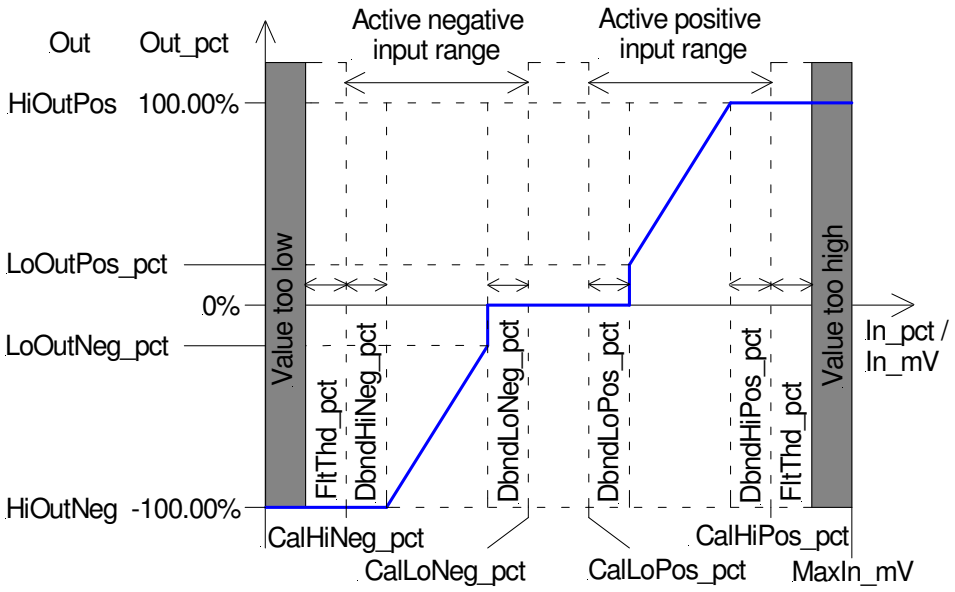
Analog Input Scaling with 4pt line and Auto-Calibration





Function:
The AnIn_4Pt_AC function block can be used for calibrating and scaling an analog input signal with a four point line. The analog signal can be given from a joystick, pedal, sensor or from another control device. The function block provides also semi-automatic calibration functions, fault detection, dead band and parameter handling functionality.

Diagram:



The active positive input range is defined by the positive lower and upper calibration point (*CalLoPos_pct, CalHiPos_pct*) as percentages of the maximum input (*MaxIn_mV*). The active negative input range is defined by the negative lower and upper calibration point (*CalLoNeg_pct, CalHiNeg_pct*) as percentages of the maximum input (*MaxIn_mV*).
If required, dead bands can be considered for all four calibration points (*DbndLoPos_pct, DbndHiPos_pct, DbndLoNeg_pct, DbndHiNeg_pct*).

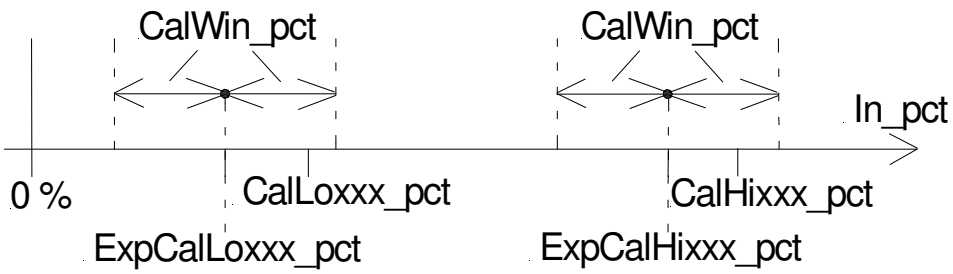
A fault threshold range (*FltThd_pct*) provides a safe range for HW tolerances versus error detection if the input value is too high or too low.

Notes:

A fault needs to be present for a certain time (*FltDetTm*) before it is declared. The used Fault timer is an up/down counter. This allows faults to be detected if they occur in more than 50% of program cycles.

StorCalLoPos, *StorCalHiPos, StorCalLoNeg*, *StorCalHiNeg* and *SetDef* are outputs intended to control the EE_PROM blocks in the parameters pages.

Calibration



xxx = Pos or Neg

It is highly recommended to start the calibration with the lower calibration point, means HW source of the analog signal is in neutral position when activating the calibration. Otherwise the calibration status message can be wrong, since the block can't distinguish if value "0" for the Lower calibration point is the correct and allowed value or if it's just not calibrated yet.

The four calibration points *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg_pct* located on Para bus must be connected to S16 memory locations. By default, they are connected to dynamic memory inside the Local_Para page. In case of using the static memory, delete the Local_Para page and use the Para bus to route the signals to the static memory.
If multiple Sensor_4Pt_AC function blocks are used in one application, the Namespace feature will have to be used or the memory names have to be changed.

In case of using the local parameters included inside the block, calibration can be accomplished by one of the three methods outlined below.

Manual Calibration

CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct and *CalHiNeg_pct* are stored in an EE memory location with a distinguishable alias for easy updating. Use the PLUS +1™ GUIDE Service and Diagnostic Tool to update *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg_pct.*

Calibration (continued)

Semi-Automatic Calibration

The four calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 1 (Enable Semi-automatic Calibration). As long as the stored values for *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg_pct* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration. The Expected Calibration Points (*ExpCalLoPos_pct, ExpCalHiPos_pct, ExpCalLoNeg_pct, ExpCalHiNeg_pct*) specify the center of the Calibration Windows. If the input value is within the calibration window for the low or high calibration points for duration *CalDetTm_ms*, the last value is captured and stored for that calibration point. After storing values for all four calibration points, semi-automatic calibration is complete. Calibration mode can be activated by either setting the Calibration Command input to 4 or if the stored values of parameters *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* are zero and the Calibration Command equals 1. *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* can be set to zero by service tool.

Semi-Automatic Calibration with enable input

The four calibration points are stored in the same EE memory locations as in Manual Calibration. The Calibration Command must be set to 2 (Enable Semi-automatic Calibration with enable input). As long as the stored values for *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* are zero, the function is not calibrated and the input is ready for Semi-Automatic Calibration with Enable Input. The Expected Calibration Points specify the center of the Calibration Windows. If the input value is within the expected window for *CalLoPos_pct* Calibration Point and the *EnbPos* Input has a rising edge (0 -> 1) the value is captured and stored. If the input value is within the expected window for *CalLoNeg_pct* Calibration Point and the *EnbNeg* Input has a rising edge (0 -> 1) the value is captured and stored. If the input value is within the expected windows for High Calibration Points for duration *CalDetTm_ms*, the last value is captured and stored. After storing values for all four calibration points, semi-automatic calibration is complete. Calibration Mode can be activated again by either setting the Calibration Command Input to 4 or if the stored values of parameters *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* are zero and if the Calibration Command equals 1. *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* can be set to zero by service tool.

Set Defaults

If the Calibration Command equals 3, the Set Defaults variable *SetDef* in the parameter bus becomes TRUE. In this case the default values for *CalLoPos_pct, CalHiPos_pct, CalLoNeg_pct* and *CalHiNeg* will be stored into memory. The default values are constants on input *DEFAULT* of these memory blocks.

Inputs/Outputs

Inputs

Item/Range	Description
Cal Cmd (U8): (0 - 4)	Calibration Command 0: Manual calibration 1: Semi Auto Cal 2: Semi Auto Cal with enable input 3: Set Calibration values to defaults 4: Clear Calibration
Rst In Flt (BOOL)	Reset of input faults: T: Fault is not latched F: Fault is latchet until fixed and power is cycled
MaxIn_mV (S32): (0 – 65000[mV])	Maximum rated input in mV Used for ratiometric calculations of calibration points, dead bands and faults
In_mV (S32); (0 – 65000[mV])	Analog Input signal in mV
EnblPos (BOOL)	Input to enable the positive part of the function block output
EnblNeg (BOOL)	Input to enable the negative part of the function block output

Outputs

Item/Range	Description
Stat (U16)	Status Code in standard bitwise pattern
Flt (U16)	Fault code in standard bitwise pattern
ActivePos (BOOL)	Active output is HIGH if OUT is > 0
ActiveNeg (BOOL)	Active output is HIGH if OUT is < 0
In_pct (U16): (0 – 10000 [0,01% of MaxIn_mV])	Analog input signal as percentage of MaxIn_mV
Out (S32)	Output value scaled to HiOut parameter
Out _pct (U16) (0 – 10000 [0,01% of HiOut])	Output value as percentage of HiOut parameter

Inputs/Outputs (continued)

Parameters

Item/Range	Description
StorCalLoPos (BOOL)	Signal used to store low calibration value for positive function part
StorCalHiPos (BOOL)	Signal used to store high calibration value for positive function part
StorCalLoNeg (BOOL)	Signal used to store low calibration value for negative function part
StorCalHiNeg (BOOL)	Signal used to store high calibration value for negative function part
SetDef (BOOL)	Signal used to set default calibration values
CalLoPos_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 5500)	Low calibration point for positive function part as percentage of MaxIn_mV.
CalHiPos_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 9000)	High calibration point for positive function part as percentage of MaxIn_mV.
LoOutPos_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output for positive function part as percentage of HiOut.
HiOutPos (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output for positive function part, 20000 is the maximum input for the DDCG function block
DbndLoPos_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point for positive function part as percentage of MaxIn_mV.
DbndHiPos_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point for positive function part as percentage of MaxIn_mV.
CalLoNeg_pct (U16): (0 – 10000[0.01% of MaxIn_mV]; default value: 4500)	Low calibration point for negative function part as percentage of MaxIn_mV.
CalHiNeg_pct (U16): (0 – 10000 [0,01% of MaxIn_mV]; default value: 1000)	High calibration point for negative function part as percentage of MaxIn_mV.
LoOutNeg_pct (U16): (0-1000 [0,01% of HiOut]; default value: 0)	Is the calibrated minimum value of the output for negative function part as percentage of HiOut.
HiOutNeg (U32): (0-20000; default value: 10000)	Is the calibrated maximum value of the output for negative function part, 20000 is the maximum input for the DDCG function block
DbndLoNeg_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the low calibration point for negative function part as percentage of MaxIn_mV.
DbndHiNeg_pct (U16): (0 – 1000 [0,01% of MaxIn_mV], default value: 0)	Dead band of the high calibration point for negative function part as percentage of MaxIn_mV.
FltThd_pct (U16): (0 to 5000 [0,01% of MaxIn_mV]; default value: 500)	Fault threshold of the lower and upper calibration points as percentage of MaxIn_mV.
FltDetTm_ms (U16): (0 – 10000 [ms]; default value: 1000)	Fault detection time in ms. The time that a fault needs to be present before it is declared

Inputs/Outputs (continued)

Parameters (continued)

Item/Range	Description
ExpCalLoPos_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 5500)	Expected value of the lower calibration point for positive function part as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
ExpCalHiPos_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 9000)	Expected value of the upper calibration point for positive function part as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
ExpCalLoNeg_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 5500)	Expected value of the lower calibration point for negative function part as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
ExpCalHiNeg_pct (U16): (0 – 10000 [0,01% of MaxIn_mV], default value: 9000)	Expected value of the upper calibration point for negative function part as percentage of MaxIn_mV, used to determine center of an acceptable calibration window.
CalWin_pct (U16): (0 – 5000 [0,01% of MaxIn_mV]; default value: 500)	Amount +/- expected calibration points used to determine acceptable calibration window. Specified by units of .01% of Snsr Pwr
CalDetTm_ms (U16) (0 – 10000 [ms]; default value: 1000)	Calibration capture time in ms

Fault and Status Messages

Fault:

The "Fault" output is the fault code of the function block.

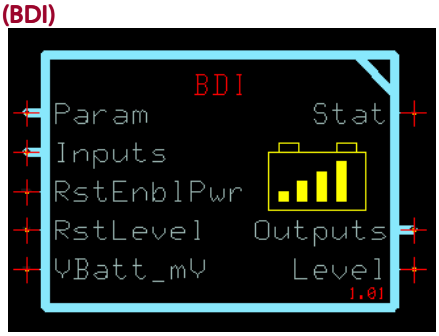
Bit Position	Value	Range/Type
--	0x0000	Input value is OK
1	0x8001	Input value is too low
2	0x8002	Input value is too high
5	0x8010	Value out of range (MaxIn_mV < In_mV) or (CalCmd > 4)
16	0xX000	Custom/Standard code bit

Status:

The "Stat" output is the status code of the function block.

Bit Position	Value	Range/Type
--	0x0000	Block is OK
1	0x8001	Block is not calibrated (CalLo_pct = 0 and CalHi_pct = 0)
2	0x8002	Block is currently in a calibration cycle (CalLo_pct ≠ 0 and CalHi_pct = 0)
3	0x8004	Parameters are corrupt
4	0x8008	Invalid Setup/ Calibration
16	0xX000	Custom/Standard code bit

Battery Discharge Indicator (BDI)



Function:

The BDI function block can be used to calculate the discharge level of a battery in steps from 10 to 1 (10 = fully charged, 1=discharded) based on discharge characteristics and with battery voltage as input value.

The Battery Discharge Indicator (BDI) is designed to cover lead acid batteries only. There are 11 discharge and one charge characteristics stored in the function block. Each characteristic consists of 10 internal voltage values. All in all 120 different threshold values are available for the calculating algorithm.
The different battery types can be handled by adjusting the parameter *BattType* for the discharge characteristics. The selection of the discharge characteristic depends on used battery and application requirements. If no information is available from battery supplier, the right type needs to be determined with measurements or trials. A basic value to determine the right characteristic is the final discharging voltage of the single cell, displayed in row "Level1". For heavy usage with high current peaks adjust "Type0" with final discharging voltage 1,53V/cell. For slow discharging without current peaks adjust Type 10 with 1,98V/cell to avoid total discharge.
A timer increases if the actual battery voltage is higher than the actual charge threshold and decreases if the actual battery voltage is lower than the actual discharge threshold value. If the charge time = 0 the charge level decreases one step. If the charge timer reaches parameter *ChgTmMax_ms* the charge level increases one step.
The actual threshold values are calculated out of the actual charge level *Level* and battery type *BattType*.

Discharge Characteristic, Voltage per Cell													Charge Char. , VpC		
Type0	Type1	Type2	Type3	Type4	Type5	Type6	Type7	Type8	Type9	Type10	Charge of battery		Type0	Charge of battery	
											Level	%		Level	%
1,950	1,963	1,974	1,986	1,997	2,006	2,010	2,014	2,021	2,026	2,030	10	100	2,350	10	100
1,903	1,922	1,938	1,954	1,970	1,982	1,989	1,995	2,005	2,011	2,018	9	90	2,333	9	90
1,855	1,880	1,901	1,922	1,943	1,959	1,968	1,976	1,988	1,997	2,005	8	80	2,304	8	80
1,808	1,838	1,864	1,890	1,915	1,936	1,946	1,957	1,972	1,982	1,993	7	70	2,271	7	70
1,760	1,797	1,827	1,858	1,888	1,913	1,925	1,937	1,956	1,968	1,980	6	60	2,242	6	60
1,713	1,755	1,790	1,826	1,861	1,890	1,904	1,918	1,939	1,953	1,968	5	50	2,213	5	50
1,665	1,713	1,754	1,794	1,834	1,866	1,883	1,899	1,923	1,939	1,955	4	40	2,188	4	40
1,618	1,672	1,717	1,762	1,807	1,843	1,861	1,879	1,906	1,924	1,943	3	30	2,158	3	30
1,570	1,630	1,680	1,730	1,780	1,820	1,840	1,860	1,890	1,910	1,930	2	20	2,125	2	20
1,523	1,588	1,643	1,698	1,753	1,797	1,819	1,841	1,874	1,896	1,918	1	10	2,113	1	10

Inputs/Outputs

Inputs

Item/Range	Description
VBatt_mV (U32)	Actual battery voltage in [mV]
RstLevel (BOOL)	Initiates a reset of the charge level, *Level* is set to 10
RstEnblPwr (BOOL)	Enables a reset of the charge level at power on when the following conditions are also fulfilled. - Power on (->Inverter was not connected to battery during charging) - *Level* <= 7 (-> battery was discharged below a certain level before power on) - *Vbatt_mV* > *VCellRst_mV* x *NmbrCells* (-> now it is fully loaded) Result of the reset: *Level* = 10, *ChgTm_ms* = *ChgTmMax_ms* (->battery is full)
ChgTmStrt_ms (U32) ([ms])	Charge timer value after power on **Note:** This value needs to be connected to an EEPROM cell (NVRam, read), which is loaded at power down.
LevelStrt (U8):(1 … 10)	Charge level value after power on **Note:** This value needs to be connected to an EEPROM cell (NVRam, read), which is loaded at power down.

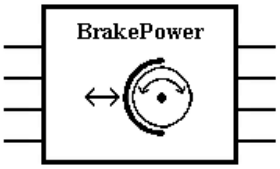
Output

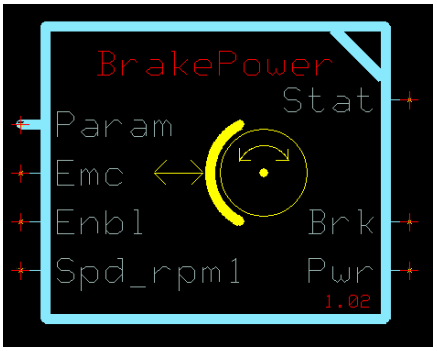
Item/Range	Description
Level (U8) (1 … 10)	Current charge level of the battery. **Note:** This value needs to be connected to an EEPROM cell (NVRam; write), which is saved at power down.
ChgTm_ms (U32): ([ms])	Current value of the discharge/charge timer **Note:** This value needs to be connected to an EEPROM cell (NVRam; write), which is saved at power down.
Stat (U16)	Status code of the function block

Parameters

Item/Range	Description
NmbrCells (U8) (6 …40, default value: 12)	Number of battery cells (^2 Volt/cell) Example: a 24V battery consists of 12 cells with a voltage of typical ~2V/cell for lead acid battery
ChgTmMax_ms (U32) (0 …1000000 [ms], default value: 240000)	Maximum charge timer value, Time between two charge levels.
VCellRst_mV (U16): (0 … 4000 [mV], default value: 2090)	Maximum voltage threshold per cell to reset the charge level at power on (= fully loaded cell)
BattType (U8): (0 … 10, default value: 3)	Selection of the discharge curve (Type x from discharge characteristic table)

Brake and Power





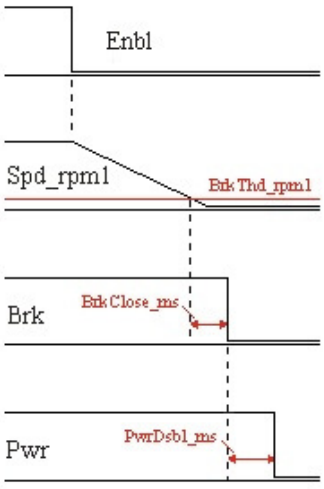
Function:

The "Brake and Power" function controls the electromechanical brake and the power stage at different driving conditions.

Start:
When the *Enbl* signal goes active (positive edge) the power stage will be enabled immediately, but the brake will be opened (powered) with a time delay (*BrkOpen_ms*).

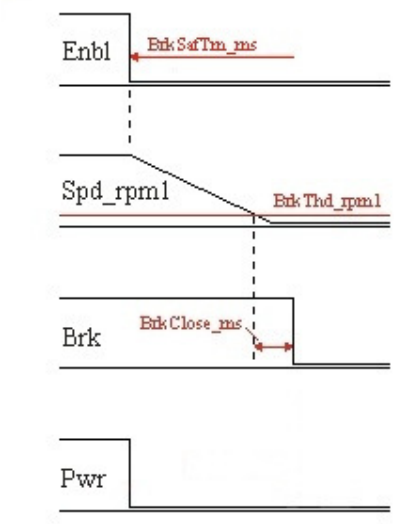
Emergency stop (Emc):
The power stage will be disabled and the brake will be closed immediately. Emergency stop has the highest priority.

Stop ramp (*BrkPwrMode* = 0):
Stop ramp mode is selected when parameter *BrkPwrMode* is set to 0. When the *Enbl* signal goes inactive the stop ramp mode will be activated. The function has to wait until the actual speed is less than a threshold value *BrkThd_rpm1* and then a timer *BrkClose_ms* will be started. After this time the brake will be closed (power off) and a second timer *PwrDsbl_ms* will be started since the brake needs a certain time close completely. At the end of this time period the power stage will be disabled.



Brake and Power (continued)

Coast (*BrkPwrMode* = 1):
When *Enbl* signal goes inactive the coast function will be activated. The power stage will be disabled immediately. Then the function has to wait until the actual speed is less than a threshold value *BrkThd_rpm1* and then a timer *BrkClose_ms* will be started. After this time the brake will be closed. At the beginning of this function, a safety timer *BrkSafTm_ms* will be started. When defined time *BrkSafTm_ms* is over the brake will be disabled in any case.



Inputs/Outputs

Inputs

Item/Range	Description
Enbl (BOOL)	Drive enable input
Emc (BOOL)	Emergency input
Spd_rpm1 (S32) ([0.1 rpm])	Actual motor speed

Outputs

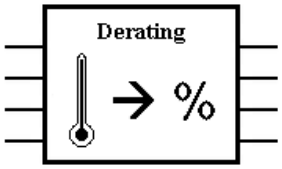
Item/Range	Description
Brk (BOOL)	Mechanical brake output
Pwr (BOOL)	Power stage enable output
Stat (U16)	Status Code for the function block

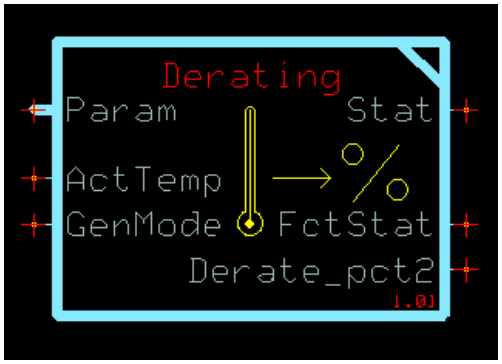
Inputs/Outputs (continued)

Parameters

Item/Range	Description
BrkPwrMode (U8): (0…1, default value: 0)	BrkPwrMode 0: stop ramp BrkPwrMode 1: coast
BrkThd_rpm1 (U16): (0…2500 [0.1 rpm]; default value: 500 rpm)	Brake close threshold
BrkOpen_ms (U16): (0…1000 [ms]; default value: 500 ms)	Brake open delay time
BrkClose_ms (U16): (0…10000 [ms]; default value: 10000 ms)	Brake close delay time
PwrDsbl_ms (U16): (0…1000 [ms]; default value: 200)	Power stage off delay time (only BrkPwrMode = 0)
BrkSafTm_ms (U16) (0…50000 [ms]; Default 5000 ms)	Brake safety time (only BrkPwrMode = 0)

Derating





Function:

This function can be used for derating the max motor current dependent on the inverter temperature as well as for a derating dependent on the motor temperature. There are two separate derating curves, one for motor mode (acceleration) and one for generator mode (deceleration).
If *ActTemp* is lower than *Temp100perc*, the output is at 10000 (100%)
If *ActTemp* is higher than *TempDerate* the output is *IDerateG* (*GenMode*=1) or *IDerateM* (*GenMode*=0)
If *ActTemp* is between *Temp100perc* and *TempDerate* the output is reduced by a linear curve between 100% and *IDerateM* (*GenMode*=0) or *IDerateG* (*GenMode*=1)

Inputs/Outputs

Inputs

Item/Range	Description
ActTemp [S16]	Actual Temperature
GenMode [BOOL]	0/F = Motor Mode 1/T = Generator Mode

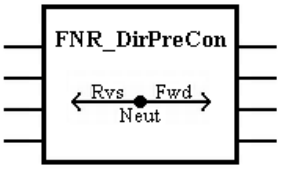
Outputs

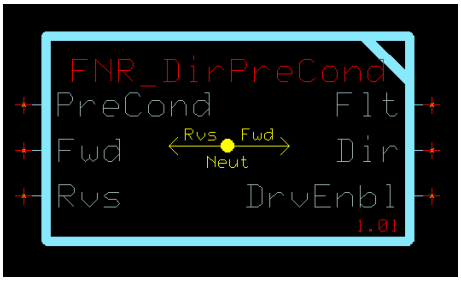
Item/Range	Description
Derate_pct2 [U16] (0.. 10.000) [0.01%]	Derating factor
FctStat [U8]	Status of the function. 0 = Temperature ok 1 = Temperature High -> Derating starts 2 = Temperature too high -> Derating at max.
Stat [U16]	Status code of the function block

Parameters

Item/Range	Description
TempDerateStrt [S16] (default value: 80)	Temperature at which the derating curve starts
TempDerateEnd [S16] (default value: 120)	Temperature at which the derating curve ends
DerateMEnd_pct2 [U16] (0…1000 [0.01%], default value: 6000)	Derated curve end point for motor mode
DerateGEnd_pct2 [U16] (0…1000 [0.01%], default value: 7000)	Derated curve end point for generator mode

Direction Signals





Function:

Use the FNR Direction block to handle the forward, neutral and reverse logic of a vehicle.
With the pre-condition input *PreCond* it can be avoided that the drive starts to work without a defined start up sequence. The pre-condition input *PreCond* must be TRUE and *Fwd* and *Rvs* input must be FALSE to generate the start up sequence and to enable *Fwd* and *Rvs* input for the selection of the drive direction. If the pre-condition input *PreCond* goes to FALSE the forward and reverse direction will be disabled.

Inputs/Outputs

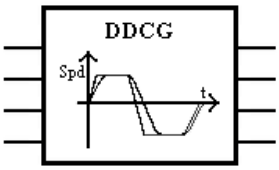
Inputs

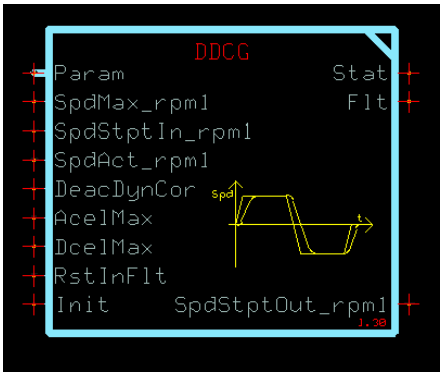
Item/Range	Description
PreCond (BOOL)	Must be TRUE to enable Fwd and Rvs switch. Fwd and Rvs must be FALSE to enable PreCond. If PreCond goes to FALSE Fwd and Rvs will be disabled
Fwd (BOOL)	Forward signal
Rvs (BOOL)	Reverse signal

Output

Item/Range	Description
Dir (S16)	Direction -1 = Reverse 0 = Neutral +1 = Forward
DrvEnbl (BOOL)	Drive enable T = Exactly one direction input is true F = neutral or Fault
Flt (U16)	Fault code of the function block

DDCG





Function:

To obtain a comfortable drive feeling the speed curve is generated with a drive curve generator dependent on the variation of the set value. Beside the actual speed, it is also considered how far and how fast the set value is changed. According to the variation of the set value a very sensitive and smooth drive feeling can also be performed as well as a dynamic driving.

Inputs/Outputs

Inputs

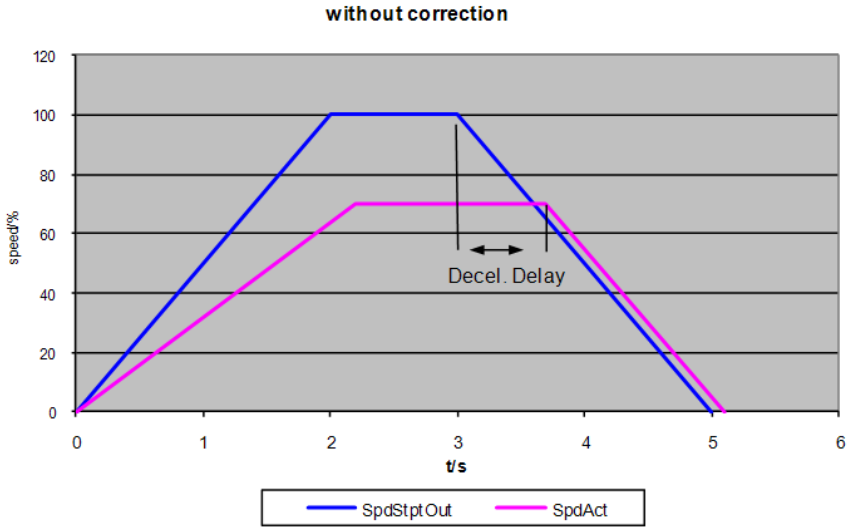
Item/Range	Description
SpdStptIn_rpm1 (S32): (-SpdMax_rpm1….SpdMax_rpm1 [0.1 rpm])	Speed set value.
SpdAct_rpm1 (S32) (-200000….200000 [0.1 rpm])	Actual speed value (motor)
SpdMax_rpm1(U32): (1…200000 [0.1 rpm])	Max. speed value of the application.
AcelMax (S32): (1….500000 [0.1 rpm/s])	**Acceleration:** Specifies the max. acceleration, without rounding and without progression (Roundn.=0, Progr.=0). The maximum acceleration is achieved, if the set value escalates from zero to maximum speed.
DecelMax (S32) (1….500000 [0.1 rpm/s])	**Deceleration:** Specifies the max. deceleration, without rounding and without progression (R=0, P=0). The maximum deceleration is achieved, if the set value jumps down from maximum speed to zero.
Init (BOOL)	Init. function of the dynamic correction. (see DeacDynCor) (0….1; pos. transition)
DeacDynCor (BOOL)	Deactivation of dynamic correction of drive curve output value: At inversion from acceleration to deceleration or at a pos. transition at “Init” input, a correction of the drive curve is made, the drive curve output value is immediately set to the actual speed value (SpdAct_rpm1), see Graph DDCG_1 and Graph DDCG_2. (0 = dynamic correction; 1 = no dyn.- correction)

Inputs/Outputs (continued)

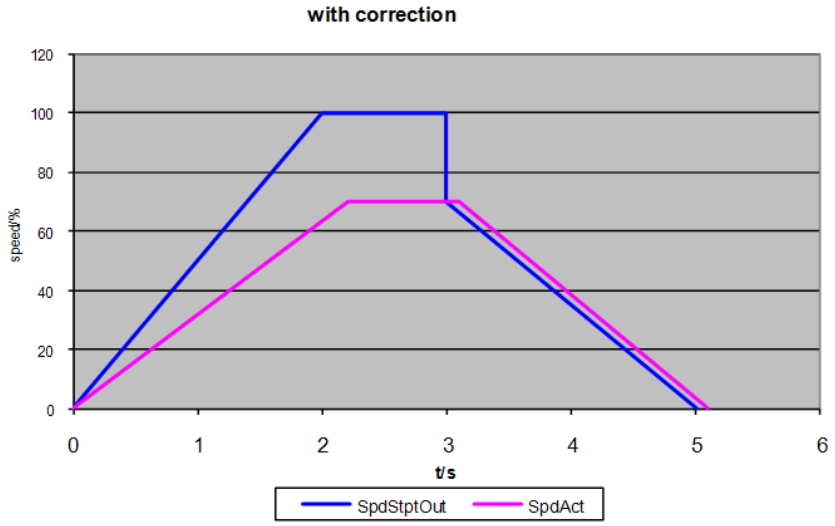
Inputs

Item/Range	Description
RstInFlt (BOOL)	Reset of the input faults TRUE: Fault is not latched FALSE: Fault is latched until fixed and power is cycled

Graph DDCG_1



Graph DDCG_2



Inputs/Outputs (continued)

Output

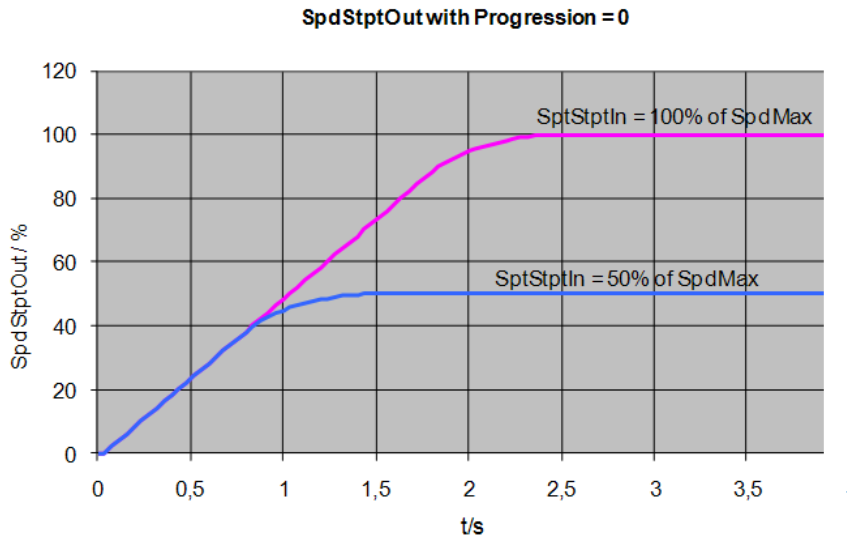
Item/Range	Description
SpdStptOut_rpm1 (S32): (-20000….200000) [0.1 rpm]	Calculated speed set value.
Stat (U16)	Status code of the function block
Flt (U16)	Fault code of the function block

Parameters

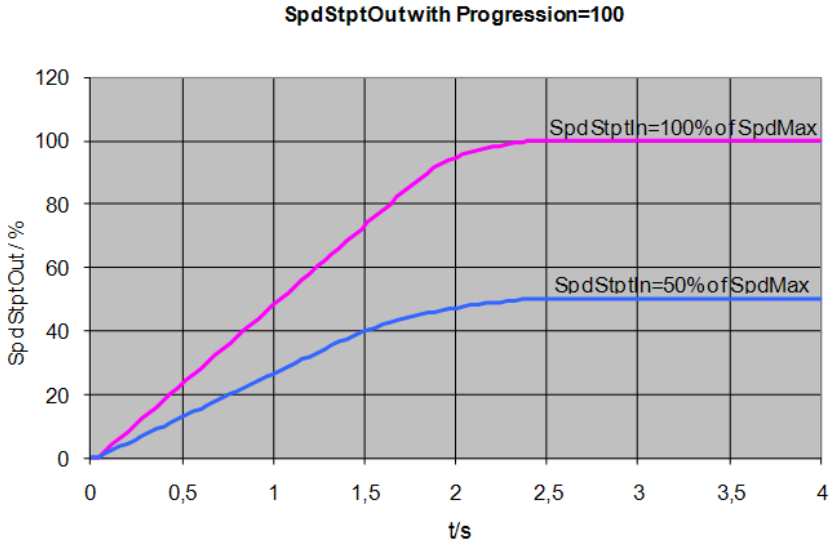
Item/Range	Description
Progression (U8) (0…100%; default value: 0)	Specifies the influence of the set value variation to the value of acceleration or deceleration. **Progression = 0:** Independently from set value variation always the maximum acceleration or deceleration is active. (Graph DDCG_3) **Progression = 100:** The value of acceleration or deceleration depends on the variation of the set value on a linear characteristic. (Graph DDCG_4)
Roundness (U8) (0…90; default value: 0)	Specifies the strength of the roundness (0: no rounding; 90: max. rounding). The speed curve is always rounded before reaching the final value. A rounding at the beginning of acceleration or deceleration becomes effective only if the set value changes slowly. With a slow change of the set value a smooth drive reaction is performed, as acceleration is increased continuously. In case of a fast change of the set value an aggressive drive reaction results, as acceleration achieves its maximum value precipitously. (Graph DDCG_5)
FltDetTm_ms (U16) (0…1000 [ms]; default value: 0)	Fault detection time The time a fault needs to be present before it is declared

Inputs/Outputs (continued)

Graph DDCG_3



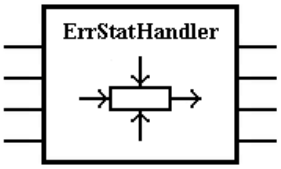
Graph DDCG_4



Inputs/Outputs (continued)

Graph DDCG_5

Error Status Handler



Function:

The error and status handler collects and administrates all errors and status events. By adding the error to a certain error level it is possible to define an output priority if more than one error occurs at same time. Always the error/status with the highest priority will be visible on Outputs *Err* or *Stat.* With the *HldErrLev*-Input an error message can be kept even if the error is no longer present.

Inputs/Outputs

Inputs

Item/Range	Description
ClrErr (BOOL)	A positive edge at the "ClrErr" input clears all error levels, which are selected with the "ClrLev" input. The error levels can only be cleared, if the input value of this error variable equals zero.
ClrLev (U8)	The "ClrrLev" input defines whether an error level variable can be cleared with the "ClrErr" input. **ClrLev (Bit0...6) → Error level 0…6 is enabled to be cleared with the "ClrErr" input**
HldErrLev (U8)	The "HldErrLev" input defines whether an error variable is held after the first occurrence of the error, even if the error disappears again. **HldErrLev (Bit0… 6) → Error level 0…6 is held**

Inputs/Outputs (continued)

Inputs

Item/Range	Description
ErrStat (Bus)	The error and status variables are located in the "ErrStat" bus. **Error variable:** **ErrLev0 (U16) 0…9999; level 0 (highest priority)** **ErrLev1(U16) 0…9999; level 1** **ErrLev2(U16) 0…9999; level 2** **ErrLev3 (U16) 0…9999; level 3** **ErrLev4 (U16) 0…9999 ; level 4** **ErrLev5 (U16) 0…9999 ; level 5** **ErrLev6 (U16) 0…9999 ; level 6 (lowest priority)** The error variable with the level 0 has the highest priority and the error variable with the level 6 has the lowest priority. If the error variables are equal to zero, no error is triggered. If an error variable is set to an error number, an error is triggered with the attendant error level. **Status variable:** **StatLev0 (U16) 0…9999; level 0 (highest priority)** **StatLev1 (U16) 0…9999; level 1** **StatLev2 (U16) 0…9999; level 2** **StatLev3 (U16) 0…9999; level 3 (lowest priority)** The status variable with the level 0 has the highest priority and the status variable with the level 3 has the lowest priority. If the status variables are equal to zero, no status report is triggered. If a status variable is set to a status number, a status report is triggered with the attendant status level.

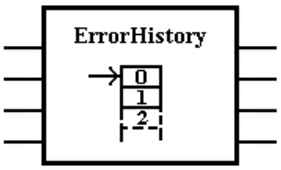
Inputs/Outputs (continued)

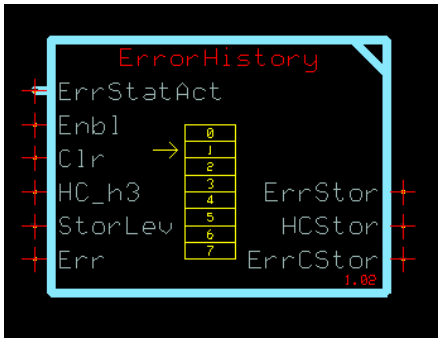
Outputs

Item/Range	Description
ErrStatAct (Bus)	The error active- and status active variables are located in the "ErrStatAct" bus. These variables indicate, whether the attendant level is active. **Error active variables:** **ErrLev0Act (BOOL), Error level 0 is active** **ErrLev1Act (BOOL), Error level 1 is active** **ErrLev2Act (BOOL), Error level 2 is active** **ErrLev3Act (BOOL), Error level 3 is active** **ErrLev4Act (BOOL), Error level 4 is active** **ErrLev5Act (BOOL), Error level 5 is active** **ErrLev6Act (BOOL), Error level 6 is active** **Status active variables:** **StatLev0Act (BOOL), Status level 0 is active** **StatLev1Act (BOOL), Status level 1 is active** **StatLev2Act (BOOL), Status level 2 is active** **StatLev3Act (BOOL), Status level 3 is active**
Err (U16) (0…9999)	The "Err" output displays the value of the active error variable with the highest priority. If the output is equal to zero, no error is active.
Stat (U16) (0…9999)	The "Stat" output displays the value of the active status variable -with the highest priority. If the output is equal to zero, no status report is active.

The error and status variables can only be connected with the "Value Connect" component.

Error History





Function:

In the error history memory the last 8 errors are stored together with a time stamp *HC_h3* and an error counter. If the same error has appeared consecutively several times, the error will be shown only once, but with the latest time stamp and with an increased error counter.

Inputs/Outputs

Inputs

Item/Range	Description
Enbl (BOOL)	If the *Enbl* input goes active (positive edge), the complete error history memory will be stored.
Clr (BOOL)	If the "Clr" input goes active (positive edge), the complete error history memory will be cleared.
HC_h3 (U32) ([0.001h])	Time stamp
Err (U16) (0…9999)	An error will be detected, if the "Err" input is unequal zero. New error is detected: "Err" is not equal to the latest error in the memory and the error level is enabled to store. - A new entry will be made in the error history memory - The oldest entry will be deleted An error is detected again: "Err" is equal to the latest error in the memory and the error level is enabled to store. - The time stamp of the latest entry will be updated. - The error counter will be increased.
ErrStatAct (Bus)	The error active- and status active variables are located in the "ErrStatAct" bus. These variables indicate, whether the attendant error level is active. See also Function Block "Error Status Handler" **ErrLev0Act … ErrLev6Act (BOOL) Error level 0…6 is active**

Inputs/Outputs (continued)

Inputs

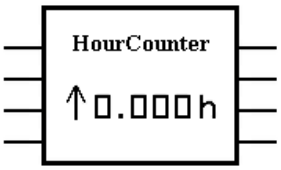
Item/Range	Description
StorLev (U8)	The "StorLev" input defines whether an error level can be stored. See also Function Block "Error Status Handler" **StorLev (Bit 0...6) Error level 0…6 is enabled to store**

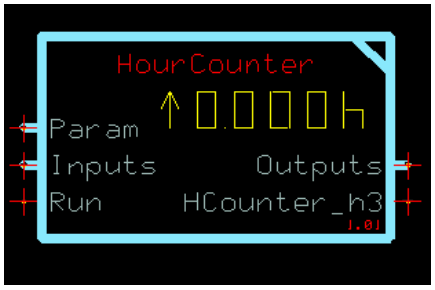
Outputs

Item/Range	Description
ErrStor (Array [8]; U16) (Err0….Err7)	Error storage
HCStor (Array[8]; U32) (HC0_h3….HC7_h3 [0.001h])	Time stamp storage
ErrCStor (Array[8]; U16) (ErrC0….ErrC7)	Counter storage

The element 0 of the array is the latest element.

Hour Counter





Function:

The Hour Counter block can be used to monitor the operating hours of a device.

Run:
If the *Run* signal is true, the output *HCounter_h3* runs up.

SetHC:
After a rising edge (0->1) on the set value "*SetHC*, the output *HCounter_h3* is set to the set value *HCVal_h3*.

HCStart_h3:
After switching-on the device, the output *HCounter_h3* is set to the input value *HCStart_h3*.

Inputs / Outputs

Inputs

Item/Range	Description
Run (BOOL)	Hour counter runs up
HCStart_h3 (U32) ([0.001h])	Hour counter value after switching-on Note: These values need to be connected to an EEPROM cell (NVRam Input), which is saved at power down.

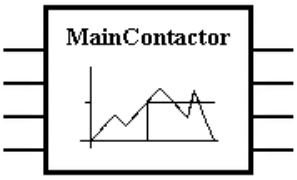
Output

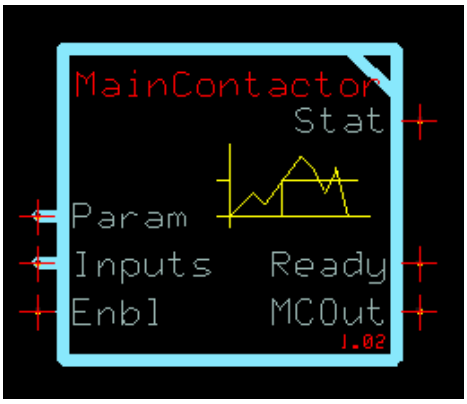
Item/Range	Description
HCounter_h3 (U32)([0.001h])	Hour counter value

Set / Set pulse values

Item/Range	Description
HCVal_h3 (U32) ([0.001h])	Set value for the hour counter Note: These values need to be connected to an EEPROM cell(NVRam Output), which is saved at power down.
SetHC (BOOL)	Sets the hour counter to the set value *HCVal_h3*

Main Contactor





Function:

The intention of this block is to switch on the main contactor after power up if the *V_DC_Link_mV* is above a defined level. The function avoids unnecessary high charge current of the DC link capacitors.
This block compares the input at *V_DC_Link_mV* with an adjustable percentage of the voltage at *PwrSupply_mV*. If the enable input is true and the DC link voltage is above that certain level the output *MCOut* is set to TRUE and stays true even if the voltage drops below this level during operation. A FALSE signal at the enable input switches off the output. A TRUE at the *Ready* output shows that the DC link voltage is as high (>95%) as the key switch voltage, meaning that the power stage really seems to be connected to the battery

Inputs/Outputs

Inputs

Item/Range	Description
Enable (Bool)	Input to enable the function.
V_DC_Link_mV (S32) ([mV])	Voltage at power stage
PwrSupply_mV (S32) ([mV])	Power supply voltage [mV] (Key switch input: C1p02)

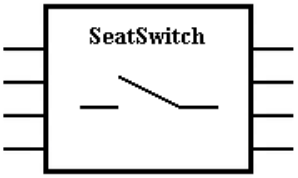
Outputs

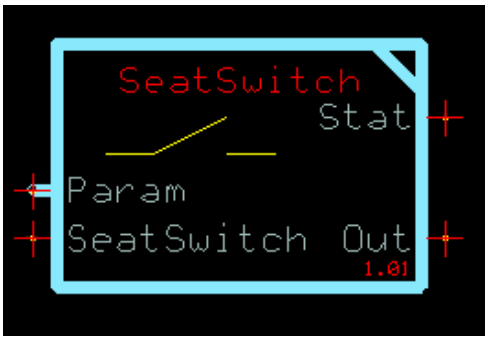
Item/Range	Description
MCOut (BOOL)	Main contactor output
Ready (BOOL)	DC link voltage is higher than 95% of the key switch voltage (power supply)
Stat (U16)	Status code of the function block

Parameter

Item/Range	Description
MCThd_pct2 (U16): (0… 10.000 [0.01% of PwrSupply_mV]; default value: 7000)	Threshold value as percentage of *PwrSupply_mV*.

Seat Switch





Function:

This function block is an on/off switch with delayed off-switching. The delay function is active on the negative transition. On a positive transition at the input signal *SeatSwitch* the output is activated immediately. On a negative transition at the input signal *SeatSwitch* the output is deactivated after an adjustable delay time.
If the input is true again during active delay time, the output stays true without any interrupts.

Inputs/Outputs

Input

Item/Range	Description
SeatSwitch (BOOL)	Signal which will be off delayed

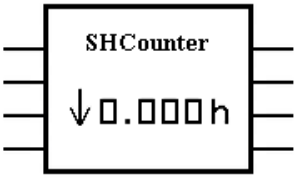
Outputs

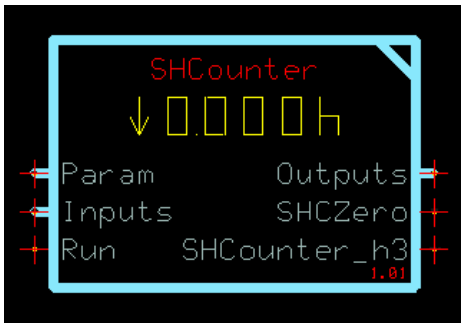
Item/Range	Description
Out (BOOL)	Off-delayed input signal
Stat (U16)	Status code of the function block

Parameter

Item/Range	Description
SeatSwDelay_ms (U16): (0 … 10.000 [ms]; Default: 1000)	Delay time of the negative transition

Service Counter





Function:

The Service Hour Counter block can be used to determine service intervals for vehicles.

Run:
If the *Run* signal is true (device is operating), the output *SHCounter_h3* runs down and stops at zero.

SHCZero:
If the output *SHCounter_h3* is equal to zero, the output *SHCZero* goes to TRUE.

SetInterval:
After a rising edge (0->1) on the parameter *SetInterval* the output *SHCounter_h3* is set to the parameter value *SHCInterval_h3*.

SHCStart_h3:
After power-on of the device, the output *SHCounter_h3* is set to the input value *SHCStart_h3*.

Inputs/Outputs

Inputs

Item/Range	Description
Run(BOOL)	Service hour counter runs down
SHCStart_h3 (U32) ([0.001h])	Service counter value after switching-on **Note:** This value needs to be connected to an EEPROM cell (NVRam Input), which is saved at power down.

Outputs

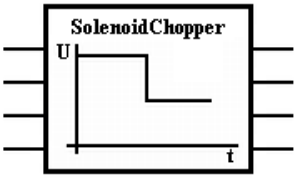
Item/Range	Description
SHCZero (BOOL)	Service hour counter is zero
SHCounter_h3 (U32)([0.001h])	Service hour counter value **Note:** This value needs to be connected to an EEPROM cell (NVRam Output), which is saved at power down.

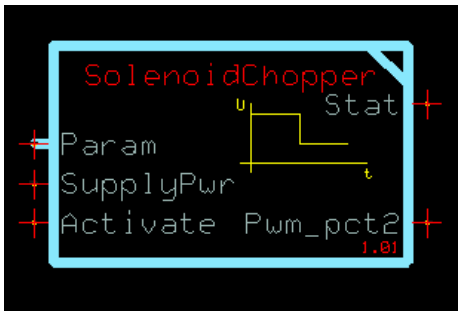
Inputs/Outputs (continued)

Parameters

Item/Range	Description
SHCInterval_h3 (U32) ([0.001h], default value: 500000)	Service interval Default: 500 h
SetInterval (BOOL)	Sets service hour counter to the service interval SHCInterval_h3

Solenoid Chopper





Function:

After a rising edge(0->1) at the input signal *Activate* the output *Pwm_pct2* is calculated according to *SettlingValue* for the time *Settling Tm_ms* and then according to *SteadyValue.*
The *Pwm_pct2* value is calculated dependant on the actual supply value *SupplyPwr*. If the actual supply value changes the *Pwm_pct2* is calculated in order to reach a constant voltage at the load.

Inputs/Outputs

Inputs

Item/Range	Description
SupplyPwr (U32)	Supply power for the according output. Can be volt or percentage. Important: This value needs to be of the same scaling and unit as *SettlingValue* and *SteadyValue!*
Activate (BOOL)	This signal starts the sequence

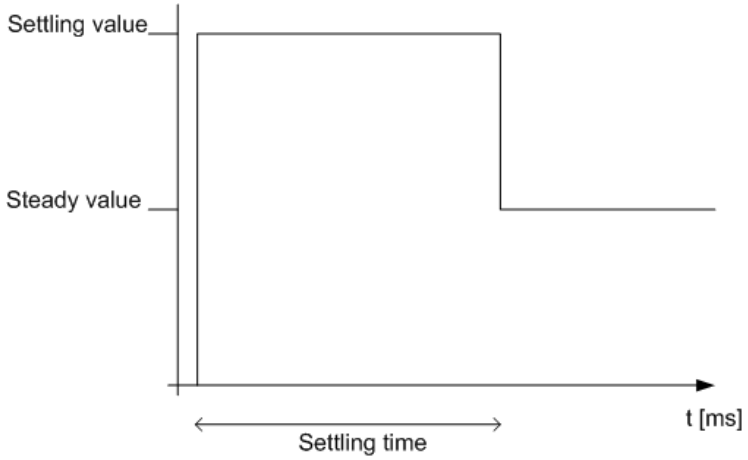
Inputs/Outputs (continued)

Outputs

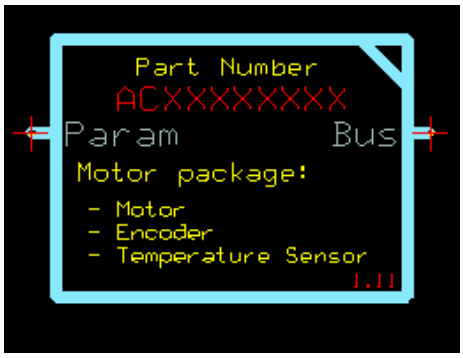
Item/Range	Description
PWM (U16): (0…10000 [0.01%])	Value defined by settling resp. steady value, calculated according to the supply power.
Stat (U16)	Status code of the function block

Parameters

Item/Range	Description
SettlingTm_ms (U16): (0… 10.000 [ms]; default value: 1000)	Time while settling value is present at the output.
SettlingValue (U32) ([mV]; default value: 10000)	Output value during settling time Important: This value needs to be of the same scaling and unit as *SupplyPwr* and *SteadyValue*!
SteadyValue (U32) ([mV])	Output value when settling time is over and Activate is still active Important: This value needs to be of the same scaling and unit as *SettlingValue* and *SupplyPwr*!



Motor Data



Function:

The information of the motor package is defined in the motor data block. The field oriented control (FOC) needs this set of motor data which has to be provided through the application interface (API). The motor data block contains also the calculation and supervision of the actual motor temperature. The encoder supervision function is also located in the motor data block.

Inputs/Outputs

Inputs - none

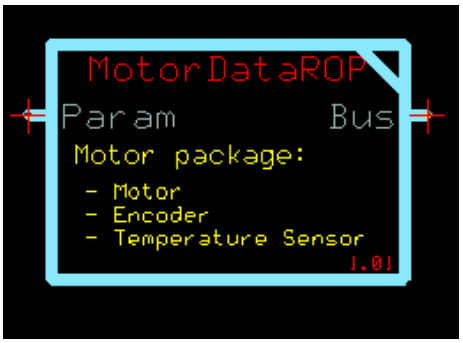
Outputs

Item/Range	Description
PartNo(U32):	Part number of the motor package.
CreData (U32)	Creation date of the motor data (YYYYMMDD)

Parameters

Item/Range	Description
EncTm_ms (U16): ([ms])	Encoder error delay time.
DefTemp (S16) (-50…200 [°C])	Default motor temperature
SnsrThd (U16) (0…12000 [Ohm])	Threshold of the motor temperature input
TempTm_ms (U16): (0…2000 [ms])	Temperature error delay time

Motor Data ROP



Function:

The information of the motor package is defined in the motor data block. The field oriented control (FOC) needs this set of motor data which has to be provided through the application interface (API). The motor data block contains also the calculation and supervision of the actual motor temperature. The encoder supervision function is also located in the motor data block. The default values of the motor data are given from a txt-file (see GUIDE User Manual). Also a read-only functionality is implemented in this motor data block (see GUIDE User Manual). After a read-only parameter file download (CSV- or LHX-file), the read-only parameters have the priority.

Inputs/Outputs

Inputs - none

Outputs

Item/Range	Description
PartNo(U32):	Part number of the motor package.
CreData (U32)	Creation date of the motor data (YYYYMMDD)
MotorDatROP (BOOL)	Read-only parameter match the parameters in the motor data block.

Parameters

Item/Range	Description
EncTm_ms (U16): ([ms])	Encoder error delay time.
DefTemp (S16) (-50…200 [°C])	Default motor temperature
SnsrThd (U16) (0…12000 [Ohm])	Threshold of the motor temperature input
TempTm_ms (U16): (0…2000 [ms])	Temperature error delay time

Version History

Overview Function Block Versions related to Library Versions

Function Block	Library V1.0 (January 2009)		Library V1.01 (August2009)		Library V1.02 (April 2011)	
	FB Version	Change	FB Version	Change	FB Version	Change
AnIn_2Pt	-	-	-	-	1.00	New
AnIn_2PtKnee	-	-	-	-	1.00	New
AnIn_2Pt_AC	1.00	New	1.1	Error "CallHi" value fixed	2.00	Complete rework
AnIn_2PtKnee_AC	-	-	-	-	1.00	New
AnIn_4Pt	-	-	-	-	1.00	New
AnIn_4Pt_AC	-	-	-	-	1.00	New
BDI	1.00	New	1.00	No change	1.01	Complete rework
BrakePower	1.00	New	1.00	No change	1.02	Complete rework
Derating	1.00	New	1.00	No change	1.01	Complete rework
FNR_DirPreCond	1.00	New	1.00	No change	1.01	Complete rework
DDCG	1.00	New	1.00	No change	1.30	Complete rework
ErrStatHandler	1.00	New	1.00	No change	1.01	Complete rework
ErrorHistory	1.00	New	1.00	No change	1.02	Complete rework
HourCounter	1.00	New	1.00	No change	1.01	Complete rework
MainContactor	1.00	New	1.00	No change	1.02	Complete rework
Roll-off	1.00	New	1.00	No change	-	Removed for this release
SeatSwitch	1.00	New	1.00	No change	1.01	Complete rework
SHCounter	1.00	New	1.00	No change	1.01	Complete rework
Shunting	1.00	New	1.00	No change	-	Removed for this release
SolenoidChopper	1.00	New	1.00	No change	1.01	Complete rework
MotorData,	1.00	New	1.00	No change	1.11	Complete rework
MotorDataROP	-	-	-	-	1.01	New

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