INSTRUCTION MANUAL

SIL 2 Load Cell/Strain Gauge Bridge Isolating Converter DIN-Rail, Power Bus and Termination Board Model D5264S

technology for safety

Characteristics

General Description:
The single channel DIN Rail Load Cell/Strain Gauge Bridge Isolating Converter D5264S module is a unit suitable for applications requiring SIL 2 level (according to IEC 61508:2010) in safety related systems for high risk industries.
The unit acts as a galvanically isolated interface installed between a PLC/DCS in Safe Area and a load cell (or a group of load cells) in Hazardous Area. Up to four 350 Ω load cells, or five 450 Ω load cells, or ten 1000 Ω load cells can be connected in parallel. It provides a fully floating power supply voltage with remote sensing capabilities to load cells located in Hazardous Area and converts the mV signal from the load cell into a 0/4-20 mA, providing both current source and sink capabilities. The module is also provided with PhotoMOS alarm output. A modbus output is also provided to interface the PLC/DCS using digital communication.
Automatic Calibration: Automatic calibration can be accomplished in the field without disconnecting the unit.
Function: 1 channel I.S. input from strain gauge signals, provides 3 port isolation (input/output/supply) and current (source or sink mode) output signal. A modbus output is also provided to interface digital device.
Signalling LED: Power supply indication (green).
Alarm indication (red).
Configurability: Totally software configurable, no jumpers or switches, input calibration, mA source/sink output signal by GM PPC5092 Adapter and SWC5090 Configurator software.
A 16 characters tag can be inserted using the configuration software.
EMC: Fully compliant with CE marking applicable requirements.

Technical Data

Supply:
24 Vdc nom (18 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp.
Current consumption @ 24 V: 100 mA with four 350 Ω load cells connected and with 20 mA output typical.
Power dissipation: 2.1 W with 24 V supply voltage, four 350 Ω load cells connected and 20 mA output typical.
Max. power consumption: at 30 V supply voltage, short circuited input, overload condition, 2.2 W.
Isolation (Test Voltage):
I.S. In/Out 1.5 KV; I.S. In/Modbus Out 1.5 KV; I.S. In/Supply 1.5 KV; Out/Supply 500 V; Modbus Out/Supply 500 V; Out/Modbus Out 500 V; Out/Alarm Output 500 V; Alarm Out/Modbus Out 500 V; Supply/Alarm Output 500 V
Input:
up to four 350 Ω load cells (parallel connection); up to five 450 Ω load cells (parallel connection); up to ten 1000 Ω load cells (parallel connection).
A/D Conversion time: 100 ms (slow acquisition mode) or 12.5 ms (fast acquisition mode).
Bridge supply voltage: 4.0 Vdc nominal.
Bridge output signal: 1 to 4 mV/V.
Line resistance compensation: ≤ 10 Ω.
Output: Fully customizable 0/4 to 20 mA, on max. 300 Ω load source mode, current limited at 24 mA. In sink mode, the external voltage generator range is V min. 3.5V at 0Ω load and V max. 30V. If generator voltage Vg > 10 V, a series resistance ≥ (Vg - 10)/0.024 Ω is needed. The maximum value of series resistance is (Vg - 3.5)/0.024 Ω.
Response time: ≤ 20 ms (10 to 90 % step).
Output ripple: ≤ 20 mVrms on 250 Ω load.
Modbus Output: Modbus RTU protocol up to 115.200 baud on Bus connector and terminals 11-12.
Alarm:
Trip point range: within rated limits of the input sensor.
Output: voltage free SPST photoMOS: 100 mA, 60 Vdc (≤ 1 V voltage drop).
Performance:
Ref. Conditions 24 V supply, 250 Ω load, 23 ± 1 °C ambient temperature.
Input:
Accuracy after autocalibration: ≤ ± 0.05 % of full scale.
Linearity accuracy: ≤ ± 0.02 % of full scale of input range.
Temperature influence: ≤ ± 0.002 % of full scale of input range for a 1 °C change.
Supply voltage influence: ≤ ± 0.002 % of full scale of input range for a min to max supply voltage change.
Analog Output:
Calibration accuracy: ≤ ± 0.05 % of full scale.
Linearity error: ≤ ± 0.05 % of full scale.
Supply voltage influence: ≤ ± 0.02 % of full scale for a min to max supply change.
Load influence: ≤ ± 0.02 % of full scale for a 0 to 100 % load resistance change.
Temperature influence: ≤ ± 0.01 % on zero and span for a 1 °C change.
Compatibility:
CE mark compliant, conforms to Directives:
2014/34/EU ATEX, 2014/30/EU EMC, 2014/35/EU LVD, 2011/65/EU RoHS.
Environmental conditions:
Operating: temperature limits –40 to + 70 °C, relative humidity max 95 % non condensing, up to 55 °C.
Storage: temperature limits – 45 to + 80 °C.
Max altitude: 2000 m a.s.l.
Safety Description:
ATEX: II 3(1) G Ex ec [ia Ga] IIC T4 Gc, II (1) D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I; ***IECEx:*** Ex ec [ia Ga] IIC T4 Gc, [Ex ia Da] IIIC, [Ex ia Ma] I
EAC-EX: 2Ex ec [ia Ga] IIC T4 Gc X; [Ex ia Da] IIIC X; [Ex ia Ma] I X
CCC: Ex ec [ia Ga] IIC T4 Gc; [Ex ia Ga] IIC; [Ex ia Da] IIIC
CML: Ex nA [ia Ga] IIC T4 Gc, [Ex ia Da] IIIC
associated apparatus and non-sparking electrical equipment.
Uo/Voc = 7.2 V, Io/Isc = 177 mA, Po/Po = 471 mW at terminals 13-14-15-16-17-18.
Um = 250 Vrms, -40 °C ≤ Ta ≤ 70°C.
Approvals:
TUV 15 ATEX 170897 X conforms to EN60079-0, EN60079-7, EN60079-11. IECEx TUN 16.0005X conforms to IEC60079-0, IEC60079-7, IEC60079-11.
EAЭC RU C-IT.AA87.B.01310/24 conforms to GOST 31610.0, GOST 31610.7, GOST 31610.11.
CCC 2020322316000978 conforms to GB/T 3836.1, GB/T 3836.3, GB/T 3834.4
CML 20JPN2136X for CML approval.
DNV No.TAA00001U0 and KR No.MIL20769-EL002 for maritime applications.
SIL 2 conforms to IEC61508:2010 Ed.2 for analog current output and for alarm output.
Mounting:
EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus or on customized Termination Boards.
Weight: about 160 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm² (13 AWG).
Location: installation in Safe Area or Zone 2, Group IIC T4.
Protection class: IP 20.
Dimensions: Width 22.5 mm, Depth 123 mm, Height 120 mm.

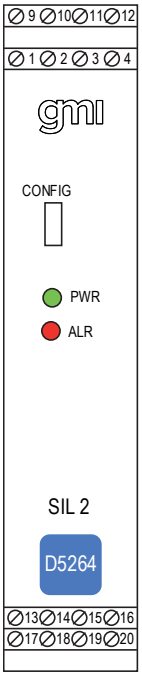
Ordering information

Model:	D5264S

Power Bus and DIN-Rail accessories:
Connector JDFT050
Cover and fix MCHP196
Terminal block male MOR017
Terminal block female MOR022

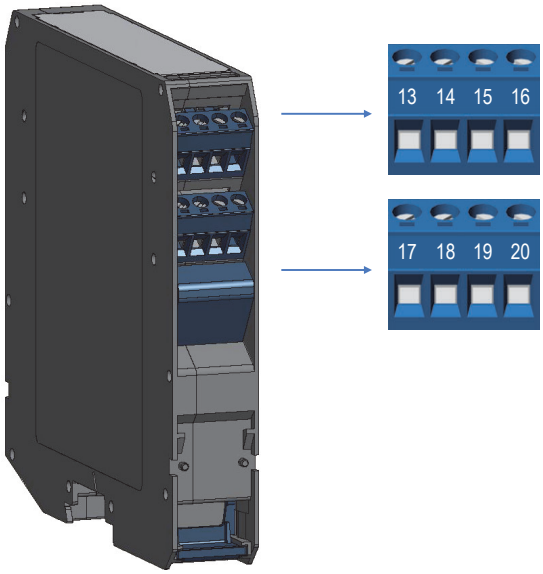
Operating parameters are programmable from PC by the GM Pocket Portable Adapter PPC5092 via USB serial line and SWC5090 Configurator software.

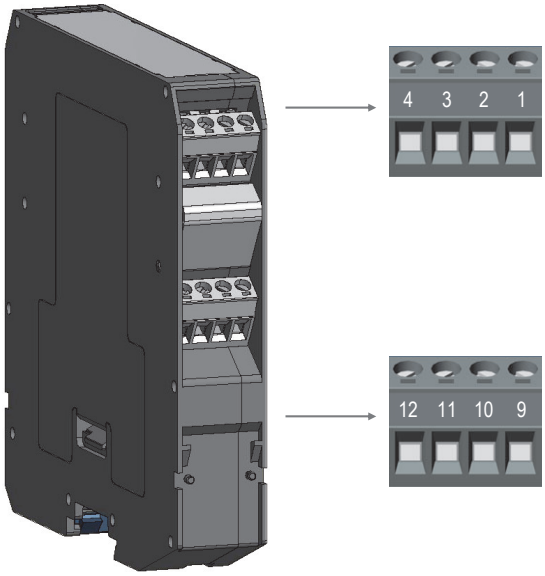
Front Panel and Features



- Input from Zone 0 (Zone 20), installation in Zone 2.
- Strain Gauge Bridge Isolated Converter.
- Up to four 350 Ω load cells in parallel or up to five 450 Ω load cells in parallel or up to ten 1000 Ω load cells in parallel.
- 0/4-20 mA Sink or Source.
- Modbus Output.
- Field Automatic Calibration.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.
- Fully programmable operating parameters.
- ATEX, IECEx, EAC Ex, CCC, CML Certifications.
- Type Approval Certificate DNV and KR for maritime applications
- High Reliability, SMD components.
- Simplified installation using standard DIN Rail and plug-in terminal blocks, with or without Power Bus, or on customized Termination Board.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.

Terminal block connections





HAZARDOUS AREA

13	+ Input Ch 1 EXC (Load cell)
14	+ Input Ch 1 Sense (Load cell)
15	- Input Ch 1 Sense (Load cell)
16	- Input Ch 1 EXC (Load cell)
17	+ Input Ch 1 IN (Load cell)
18	- Input Ch 1 IN (Load cell)
19	Not used
20	Not used

SAFE AREA

1	+ Output Ch 1
2	- Output Ch 1
3	+ Alarm Output
4	- Alarm Output
9	+ Power Supply 24 Vdc
10	- Power Supply 24 Vdc
11	A- Modbus IN/OUT RS485
12	B+ Modbus IN/OUT RS485

Parameters Table

In the system safety analysis, always check the Hazardous Area/Hazardous Locations devices to conform with the related system documentation, if the device is Intrinsically Safe check its suitability for the Hazardous Area/Hazardous Locations and group encountered and that its maximum allowable voltage, current, power (Ui/Vmax, Ii/Imax, Pi/Pi) are not exceeded by the safety parameters (Uo/Voc, Io/Isc, Po/Po) of the D5264 series Associated Apparatus connected to it. Also consider the maximum operating temperature of the field device, Check that added connecting cable and field device capacitance and inductance do not exceed the limits (Co/Ca, Lo/La, Lo/Ro) given in the Associated Apparatus parameters for the effective group. See parameters indicated in the table below:

D5264 Terminals	D5264 Associated Apparatus Parameters	Must be	Hazardous Area/Hazardous Locations Device Parameters
13 - 14 - 15 - 16 - 17 - 18	Uo / Voc = 7.2 V	≤	Ui / Vmax
13 - 14 - 15 - 16 - 17 - 18	Io / Isc = 177 mA	≤	Ii / Imax
13 - 14 - 15 - 16 - 17 - 18	Po / Po = 471 mW	≤	Pi / Pi

D5264 Terminals	D5264 Associated Apparatus Parameters Cenelec (US)		Must be	Hazardous Area/Hazardous Locations Device Parameters
13 - 14 - 15 - 16 - 17 - 18	Co / Ca = 0.3 µF Co / Ca = 1.5 µF Co / Ca = 2.2 µF Co / Ca = 2.8 µF Co / Ca = 1.5 µF	IIC (A,B) IIB (C) IIA (D) I IIIC (E, F, G)	≥	Ci / Ci device + C cable
13 - 14 - 15 - 16 - 17 - 18	Lo / La = 0.5 mH Lo / La = 6.5 mH Lo / La = 9.5 mH Lo / La = 13 mH Lo / La = 6.5 mH	IIC (A,B) IIB (C) IIA (D) I IIIC (E, F, G)	≥	Li / Li device + L cable

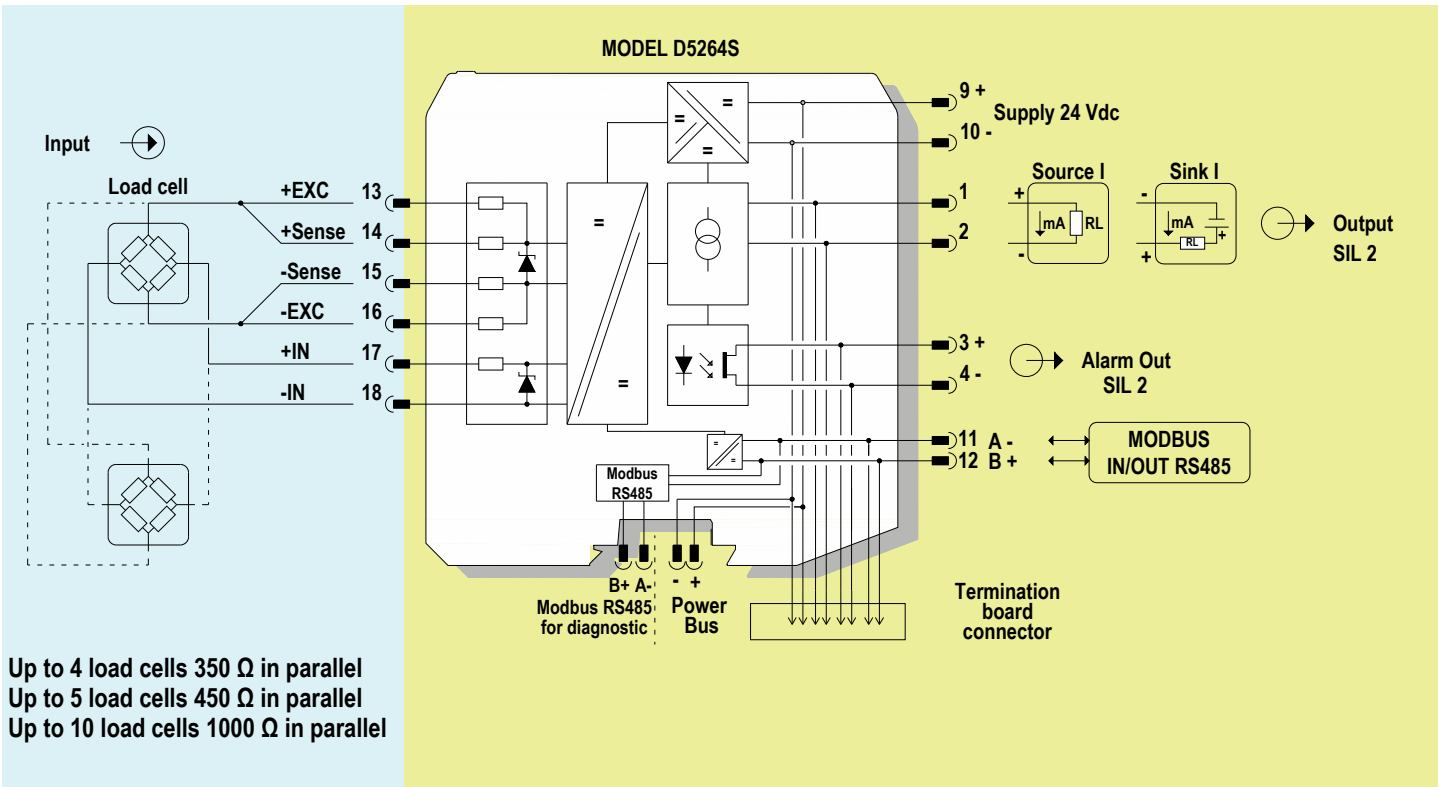
Characteristic: trapezoidal.

If the cable parameters are unknown, the following values may be used: capacitance 200 pF per meter (60 pF per foot), inductance 1 µH per meter (0.20 µH per foot).

Function Diagram

HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC

SAFE AREA, ZONE 2 GROUP IIC T4



Warning

D5264 series is an isolated Intrinsically Safe Associated Apparatus installed into standard EN/IEC60715 TH 35 DIN-Rail located in Safe Area or Zone 2, Group IIC, Temperature T4 Hazardous Area within the specified operating temperature limits Tamb –40 to +70 °C, and connected to equipment with a maximum limit for power supply Um of 250 Vrms or Vdc.
Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.
D5264 series must be installed, operated and maintained only by qualified personnel, in accordance with the relevant national/international installation standards (e.g. IEC/EN60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), following the established installation rules; particular care must be given to segregation and clear identification of I.S. conductors from non I.S. ones.
De-energize power source (turn off power supply voltage) before plug or unplug the terminal blocks when installed in Hazardous Area or unless area is known to be nonhazardous.
Warning: substitution of components may impair Intrinsic Safety and suitability for Zone 2.
Explosion Hazard: to prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or unless the area is known to be non-hazardous.
Failure to properly installation or use of the equipment may risk to damage the unit or severe personal injury.
The unit cannot be repaired by the end user and must be returned to the manufacturer or his authorized representative. Any unauthorized modification must be avoided.

Operation

The Load Cell/Strain Gauge Bridge Isolating Converter D5264 series acts as a galvanic isolated interface installed between a PLC/DCS in Safe Area/Non Hazardous Locations and a load cell (or a group of load cells) in Hazardous Area/Hazardous Locations. Up to four 350 Ω load cells, or five 450 Ω load cells, or ten 1000 Ω load cells can be connected in parallel.
It provides a fully floating power supply voltage with remote sensing capabilities to load cell located in Hazardous Area/Hazardous Locations and converts the mV signal from load cell into a 0/4-20 mA signal according to user desired range.
Remote sensing wires (terminals “14” +Sense and “15” –Sense) must be always connected to force lines (terminals “13” +Exc and “14” –Exc) for proper operation of the unit, in case of 4 wires cell connect the sensing lines near to the cell connections to minimize the power supply voltage compensation error.
The Output circuit provides both current source and sink capabilities. Modbus output is also provided to interface PLC/DCS using digital communication.
The Presence of supply power is displayed by a green signaling LED.
The module is also provided with a PhotoMOS alarm output and an alarm indication red led. The module is totally software configurable by means of the GM PPC5092 adapter and SWC5090 configuration software.

Installation

D5264 series is a Load Cell/Strain Gauge Bridge Isolating Repeater housed in a plastic enclosure suitable for installation on EN/IEC60715 TH 35 DIN-Rail, with or without Power Bus, or on customized Termination Boards. D5264 series can be mounted with any orientation over the entire ambient temperature range.
Electrical connections are accommodated by polarized plug-in removable screw terminal blocks which can be plugged in/out into a powered unit without suffering or causing any damage **(for Zone 2 installations check the area to be nonhazardous before servicing)**. Connect only one individual conductor per each clamping point, use conductors up to 2.5 mm² (13 AWG) and a torque value of 0.5-0.6 Nm. Use only cables that are suitable for a temperature of at least 85°C.The wiring cables have to be proportionate in base to the current and the length of the cable.
On the section “Function Diagram” and enclosure side a block diagram identifies all connections.
Identify the function and location of each connection terminal using the wiring diagram in the corresponding section, for example:
Connect a 24 Vdc power supply voltage between terminals “9” (positive pole) and “10” (negative pole).
Connect current source mode positive output at terminal “1” and negative output at “2” or current sink mode positive output at terminal “2” and negative output at terminal “1”
Connect serial line Modbus output at terminal “11” and at terminal “12”.
Connect strain gauge bridge voltage supply at terminal “13” positive and terminal “16” negative.
Connect strain gauge bridge voltage sensing supply at terminal “14” positive and terminal “15” negative.
If strain gauge bridge has no internal voltage sensing capability always connect terminal "14" to terminal "13" and terminal "15" to terminal "16";
for better performance connect the wire at the end of the line near the load cells.
Connect strain gauge bridge output signal at terminal “17” positive and terminal “18” negative.
Intrinsically Safe conductors must be identified and segregated from non I.S. and wired in accordance to the relevant national/international installation standards (e.g. EN/IEC60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)), make sure that conductors are well isolated from each other and do not produce any unintentional connection. Isolation in accordance with EN/IEC 60079-11 clause 6.3.13 is provided between non-intrinsically safe circuits and intrinsically safe circuits.
The enclosure provides, according to EN60529, an IP20 minimum degree of protection (or similar to NEMA Standard 250 type 1). The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1. When installed in EU Zone 2, the unit shall be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with IEC 60079-0. The enclosure must have a door or cover accessible only by the use of a tool. The end user is responsible to ensure that the operating temperature of the module is not exceeded in the end use application.
Units must be protected against dirt, dust, extreme mechanical (e.g. vibration, impact and shock) and thermal stress, and casual contacts. If enclosure needs to be cleaned use only a cloth lightly moistened by a mixture of detergent in water.
Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D5264 series must be cleaned only with a damp or antistatic cloth.
Any penetration of cleaning liquid must be avoided to prevent damage to the unit.
Any unauthorized modification must be avoided.
D5264 series must be connected to SELV or PELV supplies.
All circuits connected to D5264 series must comply with the overvoltage category II (or better) according to EN/IEC60664-1.

Start-up

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color coding, preferably blue, or by marking.
Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts.
Before turning power on, field load cell must be connected to the module. Then, turn power on, the “power on” green led must be lit, output must be in accordance with the corresponding input signal value. If possible change the load cell condition and check the corresponding Safe Area output.

Screenshot:

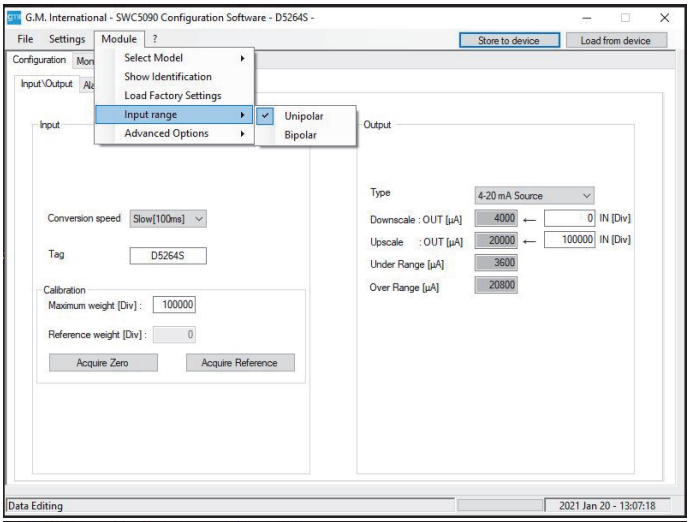
Input range:
Unipolar: the input scale ranges from 0 to the maximum value. This scale is particularly indicated to measure a weight.
Bipolar: the input scale ranges form – to + maximum value. This scale is particularly indicated for other sensors, i.e. strain gauges.
Advanced options:
Output calibration: it allows the user to recalibrate the module output.
Strain gauge calibration: it allows the user to recalibrate strain gauge input.

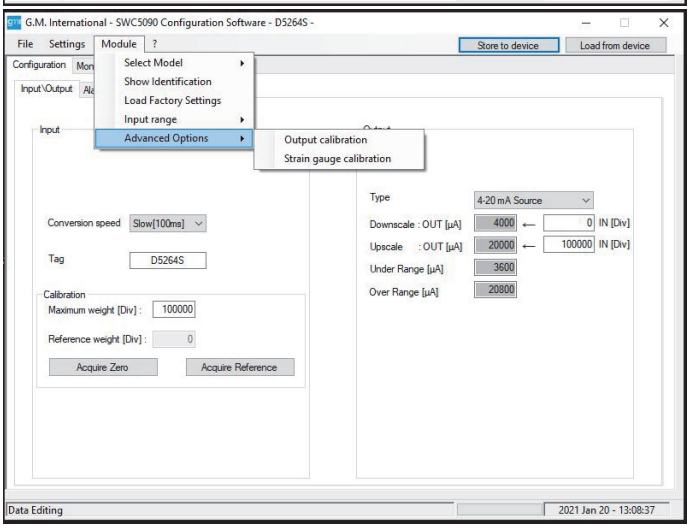
INPUT:
Conversion speed (Input data acquisition time):
Slow: 100 ms
Fast: 12.5 ms
Tag : 16 alphanumerical characters
Maximum weight: configurable from 0 to 100000 divisions. Higher values lead to greater resolutions.
Reference weight: weight used for calibration.
Configurable form 0 to selected maximum weight.
Acquire Zero : press button to start the zero acquiring procedure.
Acquire Reference : press button to start reference acquiring procedure

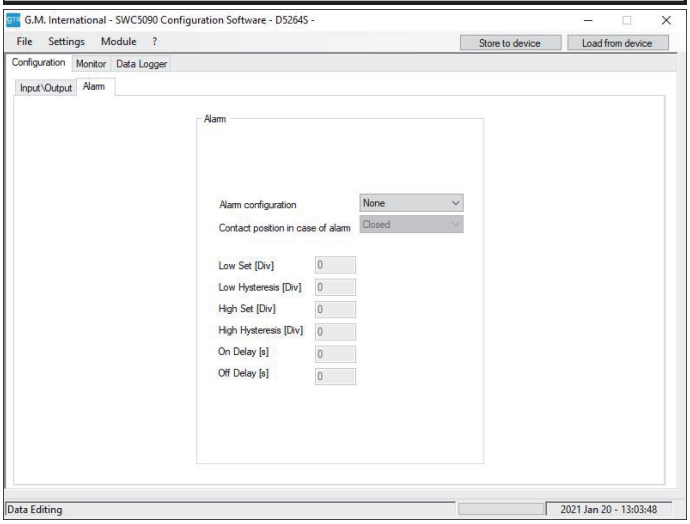
OUTPUT:
0-20 mA Sink
4-20 mA Sink
Custom Sink All Output parameters are fully customizable.
0-20 mA Source
4-20 mA Source
Custom Source All Output parameters are fully customizable.
Downscale: analog output downscale in normal working condition (range 0 to 24 mA)
Upscale: analog output upscale in normal working condition (range 0 to 24 mA)
Under range: analog output value in under range condition (range 0 to 24 mA)
Over range: analog output value in over range condition (range 0 to 24 mA)

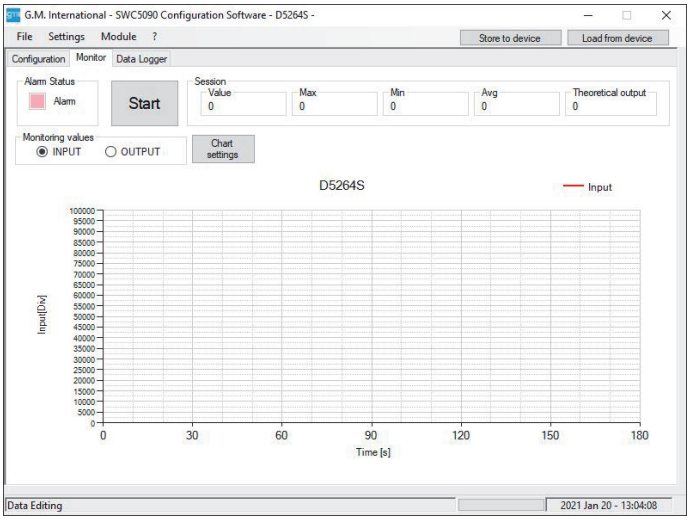
ALARM
Configuration:
None: alarm is disabled,
Low: alarm is triggered when source descends below “Low Set”,
High: alarm is triggered when source ascends over “High Set”,
Window: alarm is triggered below “Low Set” and above “High Set”,
Contact position in case of alarm:
Open: alarm output is closed under regular working conditions, and it opens in case of alarm;
Closed: alarm output is open under regular working conditions and it closes in case of alarm;

Low Set: source value below which the alarm is triggered (in Low, Window)
Low Hysteresis: hysteresis on the low set value
High Set: source value above which the alarm is triggered (in High,Window)
High Hysteresis: hysteresis on the high set value
On Delay: time for which the source variable has to be in alarm condition before the alarm output is triggered; configurable from 0 to 1000 seconds in steps of 100 ms
Off Delay: time for which the source variable has to be in normal condition before the alarm output is deactivated; configurable from 0 to 1000 seconds in steps of 100 ms









Supported Modbus functions:

Code	Name	Notes
03	read holding registers	reads a stream of words from memory
04	read input registers	reads a stream of words from memory
08	diagnostics: subcode 0	returns query data
06	write single register	writes a word in memory
16	write multiple registers	writes a stream of words in memory

Supported Modbus parameters:

The unit can communicate via Modbus RTU RS-485 protocol. Below is a list of all available registers.
Each Modbus parameter is described by one 16-bit word.
- 'Addr.' is the address of the parameter.
- 'Description' explains the function of the parameter.
- 'Rights' identifies the operation that can be executed by the user:
  RO (Read Only);
  WO (Write Only);
  RW (Read and Write).
- 'Type' indicates the kind of the variable:
  SINT8 / UINT8: signed / unsigned 8 bits integer;
  SINT16 / UINT16: signed / unsigned 16 bits integer;
  SINT32 / UINT32: signed / unsigned 32 bits integer;
  FLOAT: floating point single precision real;
  DOUBLE: floating point double precision real;
  the suffix '[n]' indicates an array of n elements of the corresponding type.

Addr.	Description	Rights	Type
IDENTIFICATION			
0	GM International code	RO	UINT16
1	Software revision	RO	UINT16
2	Product code	RO	UINT16
3	Option code	RO	UINT16
4	Hardware revision	RO	UINT16
COMMAND EXECUTION			
100	Command (*1)	WO	UINT16
MODBUS COMMUNICATION			
300	Modbus address	RW	UINT16
301	Modbus baud-rate (*2)	RW	UINT16
302	Modbus format (*3)	RW	UINT16
TAG			
700	Tag 1	RW	UINT16[8]
INPUT CONFIGURATION			
800	Integration speed (*4)	RW	UINT16
900	Input minimum user range	RW	SINT32
902	Input maximum user range	RW	SINT32
MEASURE			
1102	Sensor value [div]	RO	SINT32
OUTPUT CONFIGURATION			
1400	Output downscale	RW	SINT32
1402	Output upscale	RW	SINT32
1404	Output underrange	RW	SINT32
1406	Output overrange	RW	SINT32
1418	Input downscale	RW	SINT32
1420	Input upscale	RW	SINT32
1500	Output drive (*8)	RW	UINT16
OUTPUT DEBUG			
1702	Output virtual value	RO	SINT32
ALARM CONFIGURATION			
1800	Alarm configuration (*5)	RW	UINT32
1802	Alarm ack configuration	RW	UINT32
1806	Contact position in case of alarm (*6)	RW	UINT32
1812	Delay to alarm issue [ms]	RW	UINT32
1814	Delay to alarm removal [ms]	RW	UINT32
1816	Alarm low threshold	RW	SINT32
1818	Alarm low threshold hysteresis	RW	SINT32
1820	Alarm high threshold	RW	SINT32
1822	Alarm high threshold hysteresis	RW	SINT32
1906	Alarm virtual state (*7)	RO	UINT32

Modbus parameters details:

*1 Command List

Bit pos.	Value	Description
0..3	3	Save ModBus configuration
	4	Save Tag
	10	full eeprom write

*2 Modbus Baudrate

Bit pos.	Value	Description
0..2	0	baud rate = 4800 bit/s
	1	baud rate = 9600 bit/s
	2	baud rate = 19200 bit/s
	3	baud rate = 38400 bit/s
	4	baud rate = 57600 bit/s
	5	baud rate = 115200 bit/s

*3 Modbus Format

Bit pos.	Value	Description
0..1	0	none
	1	even
	2	odd
2..2	0	termination resistance off
	1	termination resistance on
3..3	0	32-bit endianness little
	1	32-bit endianness big
4..4	0	write protection off
	1	write protection on

*4 Integration Speed

Bit pos.	Value	Description
0..0	0	slow
	1	fast

*5 Alarm Configuration

Bit pos.	Value	Description
0..1	0	no alarm
	1	alarm low
	2	alarm high
	3	alarm window

*6 Contact Position In Case Of Alarm

Bit pos.	Value	Description
0..0	0	open
	1	closed

*7 Alarm Virtual State

Bit pos.	Value	Description
0..0	0	alarm off
	1	alarm on

*8 Output Drive

Bit pos.	Value	Description
0..0	0	output sink
	1	output source