D302 Conversion Module for Sylvac Probes Instruction Manual

Contents

D302 Conversion Module for Sylvac Probes

Specifications

- Manufacturer: Swiss
- Model: D302 / D302a, D304 / D304a
- Year: Since 1969
- Analogue Voltage Range: +/-10V
- Resolution: Up to 0.025mV

Product Usage Instructions

General Description
The D302a module provides analogue voltages corresponding to the probe positions. The D304 and D304a modules come with an extension featuring 4 sensors. Throughout this manual, D30Xy refers to D302, D302a, D304, or D304a modules.

Front

- Power LED
- Probe LEDs
- RS485 bus activity LEDs
- USB port

Back

- DIN 35mm mounting rail
- RS485 bus output and input connectors
- Configuration jumpers
- 24V power supply plug and analogue outputs
- Channel 1 and 2 probe inputs

Thermal Stabilisation
D30Xy modules include internal temperature measurement. Allow about 10 minutes for thermal stabilization after powering on the module before taking measurements.

Indicators

Power LED
The LED indicates the module power supply status: green for normal range, red for voltage out of range, and

flashing for temperature measuring error.

Probe LEDs
Green LEDs indicate connected probes, red for probe errors, and off for inactive channels. LEDs flash during thermal stabilization.

FAQ (Frequently Asked Questions)

- **Q: What is the purpose of the DIN 35mm mounting rail on the back of the module?**
  A: The DIN rail allows for easy mounting and installation of the module in various industrial settings.
- **Q: How do I calibrate the module for accurate measurements?**
  A: Refer to section 4 of the user manual for detailed calibration procedures to ensure precise readings.

Swiss manufacturer of precision measuring instruments since 1969

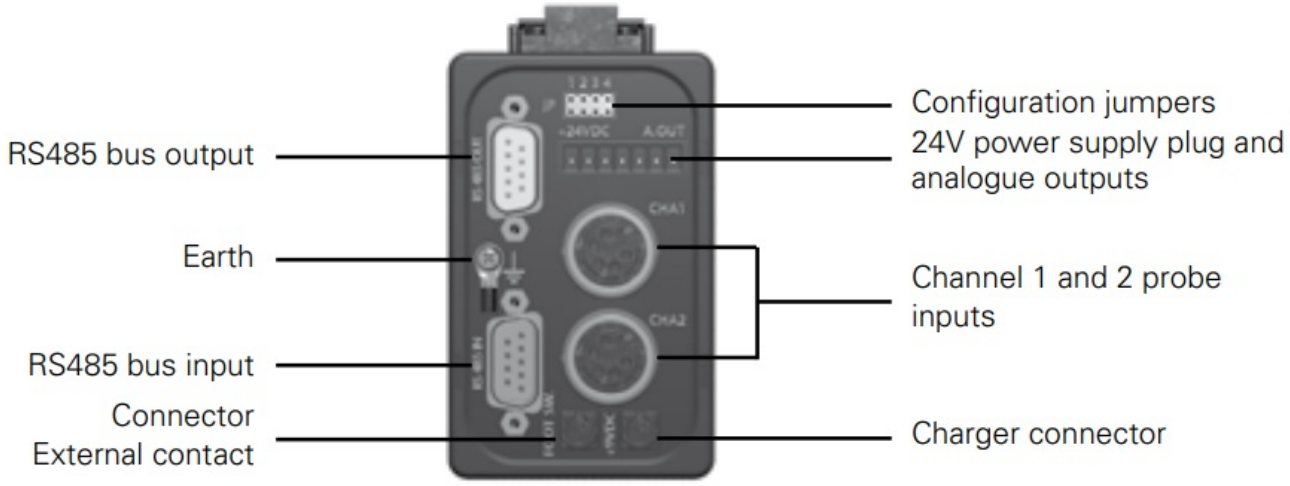
Conversion module for Sylvac probes
Module de conversion pour palpeurs Sylvac

General description

The D302 module is used to read and convert the value of the position of the two Sylvac probes up to a resolution of 0.1µm. The results are available on a USB port and on a MODBUS RS485 port. Numerous other integrated functions can be used to solve most measuring problems encountered.
The D302a module is fitted with an extension which is used to supply analogue voltages corre-sponding to the position of the probes with a range of +/-10V and a resolution up to 0.025mV. An extension with 4 sensors is available with modules D304 and D304a
In the rest of this manual, D30Xy means either a D302 module, a D304, a D302a or a D304a.

Front

Back



The earth connection is not vital but it is advisable in environments with a great deal of electro-magnetic interference.

Thermal stabilisation
D30Xy modules have an internal temperature mesurement function. When the module is turned on the probe LEDS flash until the temperature is stabilised (about 10 minutes from a cold power up). Although the module is ready for measuring from the time it is powered up it is advisable to redo a preset after the stabilisation period.

Indicators

Power LED
The LED is green if the module power supply is in the specified range. It is red if the voltage is not within the range. The LED flashes if there is a temperature measuring error. In this case, the module is ready for measuring all the same but it is advisable to wait for at least 10 minutes of thermal stabilisation after each cold power up.

Probe LEDs
Each LED is green if a probe is connected to the corresponding input. The LED is red if a probe error occurs. It is switched off if the corresponding channel is not activated The LEDs flash during the thermal stabilisation period.

Rx/Tx LEDs
The LEDs indicate activity on RS232 and RS485 buses.
They stay on constantly if there is a critical error in the flash memory.

Calibration

Module calibration
Module calibration consists of entering 2 reference points along the path of the probe and speci-fying the movement between these two points. This must be repeated for the other channels if necessary.
The module is calibrated at the factory with a standard probe. If the module is not calibrated the corresponding channel LED turns red. Calibration is performed by the CAL remote command.

Calibration procedure
For an optimum result it is advisable to perform the calibration procedure when the module is in a state of perfect thermal stabilisation, i.e. at least 2 hours after being powered up. If the module is not thermally stabilised calibration is not possible. The module returns TEMP ERR.

- For calibration using a 25 mm gauge height, send the CALi remote command (i= the number of channel 1 to 4)
- For calibration using any two gauge heights send the CALi remote command: Ref0, Ref1 (i = number of canal

1to 4 ; Ref0, Ref1 = gauge heights, normally Ref0 < Ref1)

- After a few seconds the module returns REF0? and the corresponding probe LED flashes.
- Position the probe on the first reference point and then press the foot switch or send the CAL remote command. The probe LED flashes rapidly during the reading procedure.
- After a few seconds the module returns REF1? and the corresponding probe LED flashes.
- Position the probe on the second reference point and then press the foot switch or send the CAL remote command. The probe LED flashes rapidly once more during the scan.
- The module returns CALi OK and the new calibration is saved if the procedure is correct. If the module returns CALi ERR, the calibration is not correct and it is not saved.

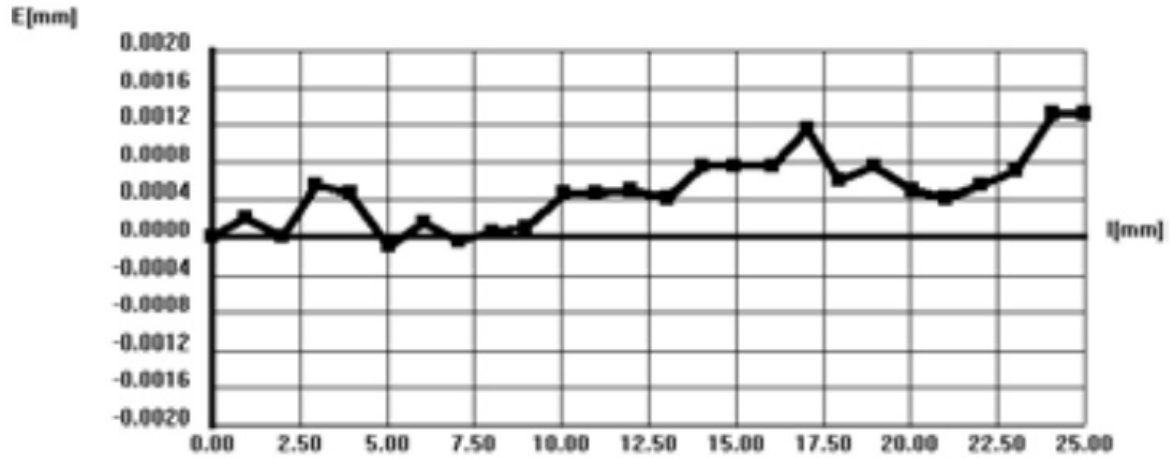
If a point by point correction was active while the module was being calibrated it is disabled but not deleted.

Diameter measurement calibration
The module can be calibrated to measure internal diameters thanks to the CALi remote com-mand: Ref0, Ref1. Use a small standard diameter like Ref0 and a large standard diameter like Ref1. Once the calibration procedure is over enter the value of the small diameter in the Preset function.

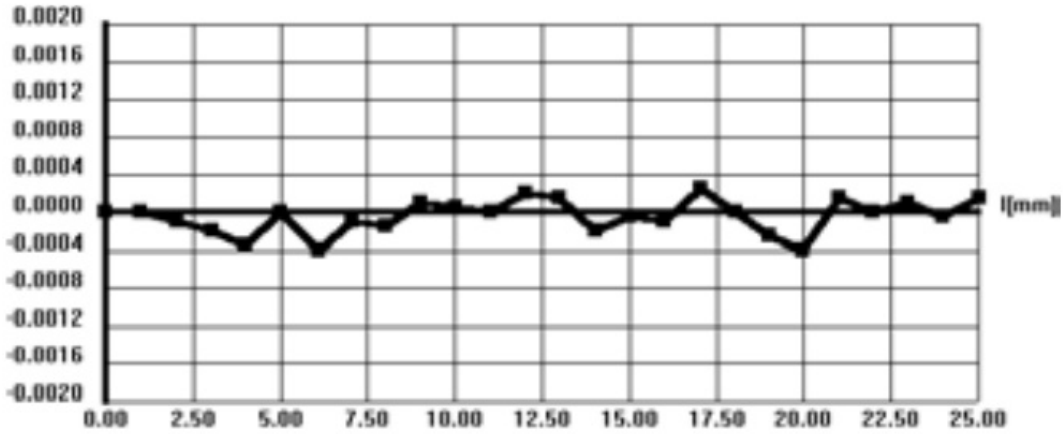
Pairing a probe and a conversion module
To increase the accuracy of the measurement it is possible to pair each module channel with its corresponding probe. This operation is independent of calibration. It consists of defining a correc-tion curve of no more than 26 points on the path of the probe and specifying a correction for each point. This must be repeated for the other channels if necessary.
For an optimum result it is advisable to perform correction point by point when the module is in a state of perfect thermal stabilisation, i.e. at least 2 hours after being powered
up. If the module is not thermally stabilised point by point correction is not possible. The module returns TEMP.ERR.

Example of correction

1. Probe P25 with D30Xy without correction -> maximum error of 1.4µm
2. Same instrument with a correction over 10 points (every 2.5mm) -> maximum error of 0.7µm



The points are inserted or modified by remote commands (see COR, LCOR and NCOR).



Active point par point correction is shown by very rapid flashing of the corresponding sensor LED during power-up.

The insertion of points must comply with the following criteria:

- The points must be numbered continuously and must start at point number 0 or 1 (if point 0 is not inserted it is automatically defined with a zero value correction).
- After each point the probe must always be moved from the probe that has left to the probe coming back.
- The correction value is limited to 2.0mm or 0.1 inches.
- The correction difference between 2 consecutive points is limited to half the distance be-tween these 2 points. Example: for 2 points 1 mm apart the correction difference between these 2 points may not be greater than 0.5mm.
- The channel must be on maximum resolution (RES1).

If one of these criteria is not observed the correction point is not saved and the module returns the error ERR.COR (point by point correction error).

Procedure for inserting a point by point correction
(The remote commands are given in brackets)

1. Prepare a set of standard gauge heights or a suitable calibration instrument.
2. Set the module to the following modes:
   Maximum resolution (RES1)
   Positive measuring direction (CHA+)
3. Place the probe on a reference point and set to zero (PRE). This point corresponds in principle to the pre-run of the probe, i.e. about 0.8mm depending on the type of probe.
4. Place the probe on the first gauge height or standard value.
5. Wait for at least 3 seconds of stabilisation.
6. Read the value (?).
7. Insert the first correction with the COR 1/ +/-x.yyyyy remote command.
   The correction value to be inserted is equal to value of the standard gauge height less the value read (taking account of the sign).
8. Repeat steps 4 – 7 for the other gauge heights or standard values.
9. After the last point has been inserted start the correction curve with COR ON and check that it has started with CORO? or by powering up the module again.

The SYL-Calibre program makes it easy to insert point by point corrections (available on request).

Analogue module calibration (D30Xa only)
The D30Xa analog modules are calibrated in the factory with a P25 reference sensor. This fac-tory calibration may not be modified. However, the user can modify the initial reference and the range of each analogue output thanks to the remote commands AREF andAVMM or AVIN (see the remote commands table). In this way the output voltage can be adapted to each monopolar
(0…10V) or bipolar (-10V…+10V) voltage and to each type of probe.

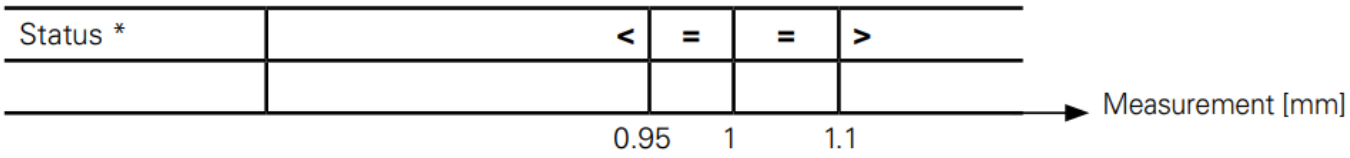
Tolerance functions

The module can be configured to measure toleranced values (see TOL remote commands). The result of the toleranced measurement is added to the position measurement (remote command?) in the form of a symbol.

- = : the value is within the tolerances
- < : The value is too small
- >: The value is too large

Example for the following parameters

	Remote command	**Value [mm]**
Enabling the tolerance function	TOL	ON
Nominal value N*	TOL **±N** ±A ±B	+1.000
Tolerance A *	TOL ±N **±A** ±B	+0.100
Tolerance B *	TOL ±N ±A **±B**	-0.050
Sending status	TOLP	ON



* If tolerance A is lower than the inserted tolerance B (internal diameter measurements) then the signs > and < are reversed.
If one of the Min/Max/Delta functions is activated, the sign corresponds to the extrema measured since the last reset (the reject sign takes precedence over the rerun sign which itself has prec-edence over the OK tolerance sign). See also remote controls TOLM ? and TOLS ?

Min/Max/Delta function

The module can be configured to search for minimum and maximum values (see remote com-
mands MIN, MAX, DEL, NOR). Searching for extrema is only active when one of the 3 modes MIN, MAX or DEL is active. The ? remote command then returns the selected extrema. When
one of the 3 modes is active the MIN?, MAX? and DEL? commands return the desired extrema.

Customised read out

Number of read/sec
The module can be configured for a customised probe position reading speed (see the remote commands RES7 or RES8). When one of these 2 resolutions is activated the user may change the number of measurements per second (SUM remote command) and configure the filtering time constant for the values read (PF remote command). SUM represents the number of internal conversions required to obtain a measurement (average value). When low SUM and PF values are programmed simultaneously the values read may be modified by a higher level of noise. The usual values for the predefined SUM and PF depending on the resolutions predefined in the module are given for reference in the following table:

	SUM [-]	**PF [ms]**	**Measurements/ second**		
			1 channel	2 channels	4 channels
RES1	14..18	180..350	~25	~ 15	~ 12
RES2	6..10	100..200	~35	~ 25	~20
RES7 / RES8	4	10..25	Max 70*	Max. 50*	Max. 40*
			Approx. 1 / (0.0015 x **SUM** + 0.008)	Approx. 1 / (0.0032 x **SUM** + 0.010)	Approx. 1 / (0.0032 x **SUM** + 0.010)

* For the highest number of measurements per second also select a high transmission speed (see BAUD) and if necessary disable one or more of the probes (see ACHA).

Synchronization of readings probes positions (D304y only)
By default, the position of each probe is read independently of the one of the other probes. For some applications (dynamic measurement of the difference in position between two probes), it is necessary to synchronize the readings of a D304y module (see remote command SYNF).

When SYNF is activated, it is possible to force a synchrone dynamic reading between the pairs of probes 1 / 3 and 2 / 4. The pairs of probes 1 / 2 and 3 /4 can't be synchronized.

Analogue outputs (D30Xa modules only)
The D30Xa modules are fitted with an independent analogue output for each of the channels. The output voltage range may be adjusted to between -10V and +10V for any probe in the Sylvac range (from 2 – 50mm) with a resolution of 0.025mV.

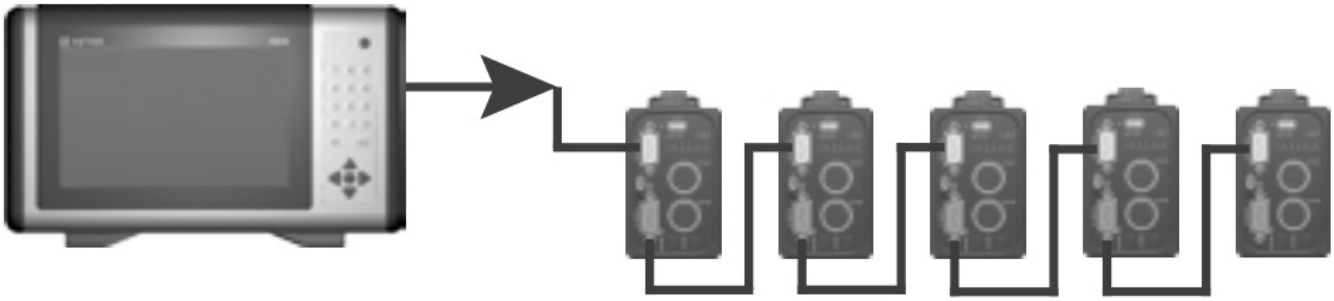
Analogue output configuration (D30Xa)
Using the AREF remote command define the reference voltage corresponding to the position of the probe Preset. Using the AVMM remote command (or AVIN for measurements in inches), define the voltage range required for moving the probe.
Example: Measurement with a P10 probe (10mm run) between -5V and + 5V. The reference is -5V. The total measurement range is 10V, therefore the factor is 1V/mm. The 2 remote commands will therefore be: AREF -5.0 <CR> (reference to -5V for the Preset position) AVMM +1.0 <CR> (1V/mm of probe run)

Remote commands
Each remote command must be followed by a "CR" (Carriage Return).
A remote command is made up of a command and, if necessary, one or more parameters.
By default the remote commands act on all the active module channels to which a probe is connected. To act on one channel in particular a selection code (F) may be inserted between the command and the parameter.
Example: ? F2 (to interrogate the value of channel 2).
Exception: The ACHA remote command always acts on all channels if code F is not specified. The module's responses to remote controls acting on several channels are separated by a TAB character between each channel. Options enable the presentation of the module's responses to be set up (see OPT remote controls).
The remote commands for pairing (point by point correction) can only act on one single channel at a time. If the

module’s two channels are active and the probes are connected, code F is manda-tory otherwise the command is not executed.
Example: COR F1 RST.
See the attached table of remote commands.

Data bus
The D30Xy module is intended to be connected to a data transmission bus. The RS485 IN bus input connector is used to connect the module to a master (D300S unit or a programmable con-troller) or to the previous module. The RS485 OUT bus output connector provides the opportunity to connect to the following module. These two connectors also transport the power as well as an external command signal (foot switch). A set of jumpers is used to cut off the power supply and/or the external command signal as well as to configure the end of line module (last module on the bus).

Architecture



Modbus protocol
Data exchanged between the master and the D302 slave modules is defined by the MODBUS protocol. See the attached table of Modbus transactions and addresses of variables.

Configuring the module’s Modbus address
The address of the D30Xy modules is not pre-defined in the factory. They therefore do not reply to any Modbus request. Before you can interact with a module using Modbus it must be config-ured with a unique bus address.

Address configuration via the USB port
See the SLA, remote command which is used to allocate an address to the module immediately before its connection to the data bus. Sending a zero SLA 0 address causes the module to be deconfigured.

Address configuration by probe movement
This procedure enables one or more modules to be configured directly by the data bus:

- The master starts the procedure with a broadcast bit writing process to the address 9536 (SET bit) then listens for a maximum of 60 seconds. All already configured modules are set to sleep mode.
- The unconfigured module for which one of the probes is moved at least 1 mm returns a zero ASCII character to the master (outside the Modbus protocol). All other modules are set to sleep mode.
- The master then sends a unique module address (between 1 and 247) by broadcast word writing to the address 8705. Only the module which is not set to sleep mode records this address.
- The master stops the configuration procedure with a broadcast bit writing procedure to the address 9536 (CLEAR bit).

The procedure may be repeated if other modules without an address are still on the data bus.

Module power supply
The Sylvac 904.4000 charger is used to supply power to up to 4 modules connected by the bus. If +24VDC is available on the power supply connector, 8 modules can be connected to the bus. In all cases check that the Power LED is green on all the modules.

Technical module specifications

Housing	Aluminium
Front	Varnished aluminium
Back	Varnished aluminium
Dimensions of D302y	Width 55mm, depth 90mm, height 88mm
Dimensions of D304y	Width 77mm, depth 90mm, height 88mm
Protection	IP 40 (in accordance with IEC 60529 specifications)
Weight of D302y	0.3 kg
Weight of D304y	0.45kg
Consumption of D302y	<150mA on Sylvac charging unit (<1.5W)
Consumption of D304y	<250mA on Sylvac charging unit (<2.5W)
Storage temperature	From –20°C – +45°C
Operating temperature	From +5°C – +40°C
Thermal stabilisation on actua- tion	About 10 minutes (LEDs flashing)
Resolution	0.1 µm (.00001'')
Measuring range	+/-9999.99999mm / 390"
Accuracy	Probe P2: 1.5µm Probe P5: 1.6µm Probe P10: 1.6µm Probe P25: 1.9µm Probe P50: 3.9µm
Accuracy of paired probe and module	Probe P2: 0.5µm Probe P5: 0.6µm Probe P10: 0.6µm Probe P25: 0.8µm Probe P50: 1.5µm
Accuracy of analogue outputs (D30Xa only)	2.0mV + probe accuracy
Number of measurements/ second Customised reading mode	0.1µm: 25/s (1 channel), 12/s (n channels) 1µm: 35/s (1 channel), 20/s (n channels) Up to 100/s (1 channel), 80/s (n channels)
Resolution of analogue outputs (D30Xa only)	0.025mV

Packaging details

See our catalogue or website **www.sylvac.ch**

Annexes

A.1 Codes for remote commands

Remote commands in bold are not dependant of the probes' chanels (F selection code is not useful).

Code	Function
?	Returns the measured value
1..4	Selects a channel to read
'A'	
A1..4	Selects the number of channels to read
ACHA ?	Returns the activation of the channels
ACHA 0 or OFF	Disables one or many channels
ACHA 1 or ON	Enables one or many channels
AREF ?	**D30Xa** only. Returns the analog reference [V]
AREF +|-xx.yyyyy	**D30Xa** only. Changes the analog reference [V] (-11.0 … +11.0)
ASUM?	**D30Xa only.** Returns the analogue channels summation
ASUM 0	**D30Xa** only. Resets the analogue channels summation
ASUM +|1 ..+|-4	**D30Xa** only. Defines the analogue channels summation
AVIN ?	**D30Xa** only. Returns the analog range factor [V/in]
AVIN +|-x.yyyyyy	**D30Xa** only. Changes the analog range factor [V/in] (+|-1.00 … +|-125)
AVMM ?	**D30Xa** only. Returns the analog range factor [V/mm]
AVMM +|-x.yyyyyy	**D30Xa** only. Changes the analog range factor [V/mm] (+|-0.04 … +|-5.0)
'B'	
BAUD ?	Returns the transmission speed of the COM port USB

BAUD xxxxxx	Changes the transmission speed of the COM port USB (4’800, 9’600, 19’200, 38’400, 56’000, 57’600, 76’800, 115’200, 128’000, 187’500, 230’400, 256’000 bds). Default = 19’200 bds
‘C’	
CAL	Acquisition of a reference value while calibrating
CAL c	Calibration of the channel c (1 to 4) on a master gauge block of 25.0000mm
CAL c : +|-xxx.yyyyy / +|-xxx.yyyyy	Calibration of the channel c (1 to 4) on two master gauge blocks or diameters of spe cific values (max 400.0mm / 15.0’’)
CHA+	Selects positive measuring direction
CHA-	Selects negative measuring direction
CHA ?	Returns the measuring direction
CHA* 1	Selects the radius measuring mode (default)
CHA* 2	Selects the diameter measuring mode (x2)
CHA* ?	Returns the radius/diameter measuring mode
CLE	Reset of the min/max/delta values
COR ?	Returns the status of the point per point correction
COR PP ?	Returns the status of one correction point
COR RST	Reset the measuring correction

Code	Function
COR 0 or OFF	Disables the measuring correction
COR 1 or ON	Enables the measuring correction
COR PP / +|- x.yyyyyy	Insert or modify a point of the correction. PP=Point Number [0…25]. Max correction : 2.0mm/0.1''
COR O?	Returns the activation status of the point par point correction (ON, OFF)
'D'	
D	Unselects all channels and disables functions A, F, L, M and N
DEL	Activates the Delta measuring mode
DEL ?	Returns the Delta value (if any of the modes Min/Max/Delta is activated)
'E'	
ECAL ?	Returns a calibration error NO.ERR No error GAGE.ERR Invalid gages PRB.ERR Probe not connected REF.ERR Invalid probe displacement CAL.ERR Invalid calibration procedure MOVE.ERR Probe not stable TIME.ERR Timeout (> 60s)
ECAL 0	Clears the calibration error
ECOR ?	Returns a correction point to point error NO.ERR No error PNT.ERR Invalid point number COR.ERR Invalid correction DIR.ERR Invalid direction PRB.ERR Invalid probe type RES.ERR Not in highest resolution NUL.ERR Empty correction CMD.ERR Invalid remote command
ECOR 0	Clears the correction point to point error

EXT X[:Y]	Actives the mode of the external contact. X = function, Y = channels X = 1 : Print X = 2 : Zero setting X = 3 : Preset X = 4 : Preset then Print X = 5 : Reset of the Min/Max/Delta values X = 6 : Turns on/off the continuous data output X = 7 : Preset on Min value X = 8 : Preset on Max value Without Y : Selection of channels unchanged Y = 0 : all activated channels or channels independent function Y = 1 : channel 1 Y = 2 : channel 2 Y = 3 : channel 3 Y = 4 : channel 4 Y = 5 : channels 1 and 2 Y = 6 : channels 3 and 4 Y = 7 : 1st channel activated then next channel
Code	**Function**
EXT ?	Returns the external contact mode (X:Y)
EXT A	Actives the external contact of the RS-485 bus for 50ms
'F'	
F1..200	Selects the number of filtration samplings
FAC RST	General Reset (factory parameters)
'G'	
GEXT XY	Configures the external contact of the bus RS485. X : Input, Y : Output X or Y = 0 : l ocal contact on the module X or Y = 1 : global contact sent on the bus RS485
GEXT ?	Returns the configuration of the external contact of the bus RS485 (XY)
'I'	
ID?	Returns the module identification (SY286 for **D30X** or SY286A for **D30Xa**)

IN	Actives the Inch unit
'L'	
L	Activates the data's memorization. Stops when memory is full or with command R or with external contact. Command N is terminated.
L2	Same as L but waits for the external contact to start the memorization
LCAL ?	Returns the date of the last calibration of the module
LCAL dd.mm.yy	Sets the date of the last calibration of the module
LCOR ?	Sets the date of the last measuring correction
LCOR dd.mm.yy	Reset the measuring correction
'M'	
M	Enables the Min/Max mode. Disables with command D. Clears data's with command R or external contact
MAX	Activates the Max measuring mode
MAX ?	Returns the Max measured value (if any of the modes Min/Max/Delta is activated)

MBD ?	Returns the transmission speed of the RS485 port
MBD xxxxxx	Changes the transmission speed of the RS485 port (4'800, 9'600, 19'200, 38'400, 56'000, 57'600, 76'800, 115'200, 128'000, 187'500, 230'400, 256'000 bds) default = 128'000 bds
MIN	Activates the Min measuring mode
MIN ?	Returns the Min measured value (if any of the modes Min/Max/Delta is activated)
MM	Actives the millimeter unit
MOD ?	Returns the active mode (NOR or MIN or MAX or DEL)
MUL ?	Returns the value of the multiplicative factor
MUL+|-xx.yyyyy	Modify the multiplicative factor (+|-0.00100 … +|-10.00000)

'N'	
N1..9999	Loads the readings counter
NCAL ?	Returns the date of the next calibration of the module
NCAL dd.mm.yy	Sets the date of the next calibration of the module
Code	**Function**
NCOR ?	Returns the date of the next measuring correction
NCOR dd.mm.yy	Sets the date of the next measuring correction
NOR	Activates the Normal measuring mode (deactivates the min/max/delta values)
NUM ?	Returns the module number
NUM XXXX	Modifies the module number (0…9999)
'O'	
OUT 0 or OFF	Disables automatic data transmission
OUT 1 or ON	Enables automatic data transmission
OUTR ?	Returns the data rate output [ms] (0=max rate)
OUTR xxxx	Modify the data rate output (0…9999 ms)
'P'	
PF ?	Returns the user probes filter time constant [ms]
PF xxx	Modify the user probes filter time constant (0…9999 ms)
PRE	Actives the memorized preset value
PRE ?	Returns the preset value
PRE+/-xxxx.yyyyyy	Insert the preset value (max 9999.99999mm/390''). Sign is recommended.
PREMIN	Preset on the Min value
PREMAX	Preset on the Max value

PRI or P	Sends the measured value [and the tolerance sign <, >, =]

PRINT ?	Returns status of all print options Option TXT : Adds spaces to align output values (default ON) Option XLS : Adds a s pace in front of signed values (default ON) Option SIGN : Replaces the + sign by a space (default ON) Option TAB : Adds a TAB between channels (default ON) Option SP : Adds a space between channels (default OFF) Option CR : Adds a CR between channels (default OFF) Option LF : Adds a LF after CR (default O FF) Option CHA : Adds a CHAx: before the parameter (default OFF) Option STO : Clears the Hold function after each Print (default OFF) Option DOT : Uses the dot as decimal separator else comma (default DOT separator) Option NAME xxxxxx : Adds the chanel name xxxxxx for each printed value (max 6 characters) (Options TAB, SP and CR are mutually exclusive)
PRINT xxx ?	Returns status of print option xxx
PRINT xxx 0 or OFF	Disables the print option xxx
PRINT xxx 1 or ON	Enables the print option xxx
'R'	
R	Reads a chanel
R1..500	Reads the memorized data's
RES X	Actives the resolution X = 1 : 0.0001mm, 0.00001'' X = 2 : 0.001mm / 0.0001'' X = 3 : 0.01mm / 0. 001'' X = 4 : 0.1mm / 0.01'' X = 5 : 0.0005mm / 0.00005'' X = 6 : 0.005mm / 0.0005'' X = 7 : 0.0001mm / 0.00001'' user settings X = 8 : 0.001mm / 0.0001'' user settings
RES ?	Returns the resolution
RS232 ?	Returns the USB port COM configuration.

RS232 bbbbb, NN, PP, SS	Changes the USB port COM configuration. Baud rate bbbbb [4800..256000], Nb bits NN [7B or 8B], Parity PP [PE or PO or P-], Stops bits SS [1S or 2S]
Code	**Function**
RS485 ?	Returns the RS485 port COM configuration.
RS485 bbbbb, NN, PP, SS	Changes the RS485 port COM configuration. Baud rate bbbbb [4800..256000], Nb bits NN [7B or 8B], Parity PP [PE or PO or P-], Stops bits SS [1S or 2S]
RST	Reset the module (user parameters)
'**S**'	
S	Activates the external contact for 500ms
S10..2500	Activates the external contact for n ms
SET ?	Returns the configuration of the chanels (activated channel, measuring unit, Resolution, Direction, Radius/Diameter, Mult Factor, Normal/Min/Max/Delta, locked channel)
SLA ?	Returns the Modbus address of the module (0 = unconfigured module)
SLA xxx	Changes the Modbus address of the module (1…247, 0 for address erasure)
SN ?	Returns the serial number of the module (fixed parameter)
STO ?	Returns the status of a channel
STO 0 or OFF	Unlocks a channel
STO 1 or ON	Locks a channel

SUM ?	Returns the user probes reading summation
SUM xxx	Modify the user probes reading summation (1…200)
SYNF ?	Returns the probe synchronization status (D304y only
SYNF 0 or OFF	Independant probe reading (default)
SYNF 1 or ON	Synchronized probe reading (D304y only)
‘T’	
TOL ?	Returns the tolerances set (Nominal value, Tolerance A, Tolerance B, function status and measuring symbol)
TOL +|-xxx.yyyyyy +|-xxx.yyyyyy +|-xxx.yyyyyy	Enters the tolerances set (Nominal (+/- 9999.99999mm/390’’), Tolerance A, Toleranc e B (+/- 400mm/15’’)) Signs are recommended. Tolérance A > tolérance B : External measurement Tolérance A < tolérance B : Intern al measurement
TOL 0 or OFF	Deactivates the tolerances
TOL 1 or ON	Activates the tolerances
TOLM ?	Returns the print status of the min / max measure
TOLP ?	Returns the print status of the tolerances
TOLP 0 or OFF	Deactivates the print of the status of the tolerances
TOLP 1 or ON	Activates the print of the status of the tolerances
TOLS ?	Returns the print status of the current measure
‘U’	
UNI ?	Returns the current unit mode (MM or IN)
‘V’	
V	Returns the firmware version
VER ?	Returns the version and date of software (Vx.yza)

A.2 COM port USB, transmission errors

Code	Type of errors
ERR0	Command not executed, deactivated function
ERR1	Parity error
ERR2	Unknown format
ERR3	Timeout
ERR4	Capacity Overflow, more than 100 characters without CR
ERR5	Command not executed, unauthorized function.
ERR6	Overrun error
ERR7	Frame error
ERR8	Break of transmission error
ERRA	Not critical error of Flash memory
ERRB	Critical error of Flash memory (RX and TX LEDs turned on)
CALx.ERR	Invalid calibration procedure on probe x
CORx.ERR	Invalid correction point to point on probe x
Px.ERR	Probe x error (not connected)
TEMP.ERR	Temperature not stabilized (CAL or COR remote command)

COM port USB (RS-232), configuration parameters

Baud rate	4’800…256’000 bds (transmission speed, default = 19’200 bds)
Parity	Even
Data Bits	7
Stop bits	2
Flow Control	None

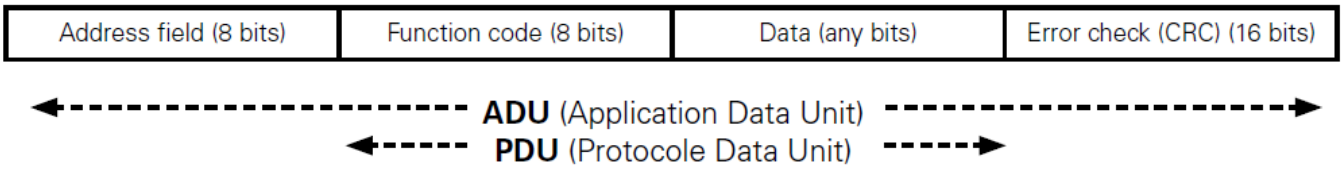
A.3 Modbus transactions

The master issues a Query Modbus frame on the bus. The addressed salve answers (except for broadcast requests) with a Response Modbus frame. The salve answer can be a correct answer or an Exception in case of error.
For better data throughput, Sylvac modules always use the RTU transmission mode.
For more details on Modbus protocol, refer to the MODBUS Application Protocol.
www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf.

A.4 Frame description

Query frame format

Query frame format



Where :
Address field: The slave number (1…247, 0=reserved for broadcast)
Function code: See following table for supported D30Xy functions
Error check (CRC): Based on polynome 1 + X2 + X15 + X16

Normal response frame format

Function code (8 bits)	Data (any bits)	Error check (CRC) (16 bits)

Exception response frame format

Function code + 0x80 (8 bits)	Exception code (8 bits)	Error check (CRC) (16 bits)

Table of supported D30Xy modbus functions

Function code	**Description**	**PDU request format**	**PDU answer format**
01	Read n bits	0x01 aaaa nnnn	0x01 bb ll
02		0x02 aaaa nnnn	0x02 bb ll
03	Read n registers	0x03 aaaa nnnn	0x03 bb ll
04		0x04 aaaa nnnn	0x04 bb ll
05	Write 1 bit	0x05 aaaa yy00	0x05 aaaa yy00
06	Write 1 register	0x06 aaaa vvvv	0x06 aaaa vvvv
07	Read fast status byte	0x07	0x07 ff Any bit set in ff indicates a n ew available probe position Bit 0 : New data for chanel 1 Bit 1 : New data for chanel 2 Bit 2 : New data for chanel 3 Bit 3 : New data for chanel 4
08 00	Echo diagnostic	0x08 0x00 llll	0x08 0x00 llll
08 01	Restart communication (vvv v = 0xFF00 to clear the event counter of function 11, 0x0000 to keep it)	0x08 0x01 vvvv	0x08 0x01 vvvv

Function code	Description	PDU request format	PDU answer format
08 02	Read diagnostic register	0x08 0x02 0x0000	0x08 0x02 vvvv Bits of vvvv : Bit 0 : Rs485 hardware error Bit 1 : Rs485 software error Bit 2 : Module flash error Bi t 3 : Slave configuration erro r
08 04	Listen only	0x08 0x04 0x0000	(No response)
08 10	Clears all diagnostic register s	0x08 0x0A 0x0000	0x08 0x0A 0x0000
08 11	Reads bus messages count er	0x08 0x0B 0x0000	0x08 0x0B nnnn
08 12	Reads invalid bus messages counter	0x08 0x0aC 0x0000	0x08 0x0C nnnn
08 13	Reads exceptions counter	0x08 0x0D 0x0000	0x08 0x0D nnnn
08 14	Reads slave addressed messages counter	0x08 0x0E 0x0000	0x08 0x0E nnnn
08 15	Reads broadcast messages counter	0x08 0x0F 0x00a00	0x08 0x0F nnnn
08 16	Reads NAK messages coun ter	0x08 0x10 0x0000	0x08 0x10 nnnn
08 17	Reads Slave busy counter	0x08 0x11 0x0000	0x08 0x11 nnnn
08 18	Reads bus overrun counter	0x08 0x12 0x0000	0x08 0x12 nnnn
08 20	Clears overrun counter	0x08 0x14 0x0000	0x08 0x14 0x0000
11	Reads event counter	0x0B	0x0B nnnn
15	Write n bits	0x0F aaaa nnnn bb ll	0x0F aaaa nnnn
16	Write n registers	0x10 aaaa nnnn bb llll	0x10 aaaa nnnn
17	Reads module identification	0x11	0x11 nn ID[] R/S

With :

aaaa	Address	nn	Quantity of data (1 byte)
bb	Number of bytes	nnnn	Quantity of data (2 bytes)
ff	Fast byte	yy00	Bit state
ll	Bytes list	vvvv	Word value
llll	Registers list	ID[]	Identification. Could be : D302# or D302A# or D304# or D304A#, followed by the slav e number (1 byte binary)
R/S	Run/Stop byte (0xff = Run, 0x00 = Stop))		

A.5 Adresses of the Modbus variables
The access to the addressed variables is possible through the functions 1..6, 15, 16.
Function 7 allows a fast access to a new data probe position.
Note: In the following description, all adresses of variables are given in decimal, not in hexadecimal.
The variables of D30Xy module corresponding to the probes are accessible in two different ways.

Table A: The variables are grouped by probe to addresses 0…499 for the 1st probe, 500…999 for the 2nd probe, etc..
Access formula for any variable:

- Adr.PN = Adr.P0 + (N x 500) where:
- Adr.PN = variable address for the N probe
- Adr.P0 = variable address for the 0 probe
- N = probe number (0 to 3)

Table B: The variables are grouped by variable to addresses 4000, 4001, 4002, 4003 for the first variable of the 4 probes, 4008, 4009, 4010, 4011 for the second variable of the 4 probes etc. Access formula for any variable:

- Adr'.PN = 4000 + Adr.P0 x 8 + (N x T) where:
- Adr'.PN = variable address for the N probe in Table B
- Adr.P0 = variable address for probe 0 in Table A
- N = probe number (0 to 3)
- T = size of the variable (in number of 16 bit words)

The other general variables of the D30Xy module that do not depend on the probes are accessible in Table C at addresses 8000…9999.
Two independent memory areas containing 10,000 addresses are overwritten for bit access or word access.
Access to an address not defined by Sylvac returns an error. All the addresses are between 0 and 9999.

Access to a variable may be:

- Read and write (R/W)

- Read only (RO)
- Write only (WO)
- R/W* indicates that a variable can be read but always returns 0.
- RO∆ indicates that the value can only be read once (reading causes the variable to be reset to zero)

Access to a probe position variable while the probe is not connected returns the code -1 (not a number, NAN in the usual IEEE754 float format).

A.5.1 Address of the Modbus bit variables

Function	Address (decimal)	Nb of bits	Access type	Comment
Freezes the measurement	0000	1	R/W	0 to release
Min., max. and delta reset to zero	0001	1	R/W*	
Preset recall	0002	1	R/W*	
Preset on Min value	0003	1	R/W*	
Preset on Max value	0004	1	R/W*	
Probe activation	0064	1	R/W	0 to disable
Measurement in inches	0065	1	R/W	0 for measurement in mm
Absolute measurement	0066	1	R/W	0 for relative measurement
Negative measurement direction	0067	1	R/W	0 for positive direction
Activated tolerances	0068	1	R/W	0 for disabled tolerances
Printing of activated tole- rances	0069	1	R/W	0 for disabled printing
Active diameter mode	0070	1	R/W	0 for inactive diameter mode
Correction point per point activated	0074	1	R/W	1 to enable, 0 to disable correction
Stored correction point per point	0128	1	RO	0 : no stored correction 1 : stored correction

Reset of correction point p er point	0192	1	R/W*	1 to reset the correction
Freezes the measurement of all channels.	8000	1	R/W	0 to release
RS-485 bit length	8128	1	R/W	0 : 7 bits data – 1 : 8 bits data
RS-485 stop bits	8129	1	R/W	0 : 1 stop bit – 1 : 2 stop bits
RS-485 parity odd/even	8130	1	R/W	0 : Odd / 1 : Even
RS-485 parity on/off	8131	1	R/W	0 : without parity / 1 : with parity
Global foot pedal input	8133	1	R/W	0 : inactive input / 1 : active input
Global foot pedal output	8134	1	R/W	0 : inactive output / 1 : active output
Probe synchronization on/o ff	8135	1	R/W	0 : without synchro / 1 : with synchro
Temperature of module	8576	1	RO	Bit set = temperature stable

User reset	9024	1	R/W*	
Factory reset	9025	1	R/W*	
1s pulse on external contact	9026	1	R/W*	
Probe LEDs flash for 5 sec onds	9027	1	R/W*	
Configuration procedure st arts (see Module Modbus a ddress configuration)	9536	1	R/W	0 to end the configuration procedure

A.5.2 Adresses of the Modbus word variables

F32 means a Float value coded according to IEEE754.
F64 means a Double float value (these variables should preferably be used if the probe positions exceed 400mm or 15”, in order not to lose the measuring precision).

Function	**Address (deci mal)**	**Nb of bits**	**Access type**	**Comment**
Probe position	0002	F32	RO	In 1/10th of um

Information bits 1	0004	8+8	8RW+8RO	Bit 0: Frozen measurement Bit 1: Reset min/max/delta to 0 Bit 2: Preset roll in Bit 8: probe P10 Bit 9: probe P25 Bit 10: probe P50 Bit 11: probe P5 or P2 Other bits reserved for future use
Information bits 2	0005	16	RO	• Bit 0: Inch unit • Bit 1: Negative direction Bit 2: Activated channel Bit 3: Bit 20 resolution • Bit 4: Bit 21 resolution • Bit 5: Bit 22 resolution Bit 6: Min. mode • Bit 7: Max. mode Bit 8: Delta mode • Bit 9: Frozen measurement Bit 10: Tolerances • Bit 11: Tolerance printing Bit 12: PP correction • Bit 13: Probe error Bit 14: Invalid probe • Bit 15: Uncalibrated probe
Formatted probe position	0006	F32	RO	Formatted probe position (see below)
Formatted min. value	0008	F32	RO	Formatted probe position (see below)
Formatted max. value	0010	F32	RO	Formatted probe position (see below)
Formatted delta value	0012	F32	RO	Formatted probe position (see below)
Last probe error	0014	16	RO∆	Bit 13: Probe error Bit 14: Invalid probe Bit 15: Uncalibrated probe Other bits reserved for future use

64 bits formatted probe position	0032	F64	RO	Formatted probe position (see below)

64 bits formatted min. va lue	0036	F64	RO	Formatted probe position (see below)
64 bits formatted max. v alue	0040	F64	RO	Formatted probe position (see below)
Access to bits 0000- 0031	0056	2×16	RW	See corresponding bits (probe A)
Formatted Preset value	0060	F32	RW	Formatted probe position (see below)
Nominal value for tole- ra nce, formatted.	0062	F32	RW	Formatted probe position (see below)
Formatted upper tole- ra nce	0064	F32	RW	Formatted probe position (see below)
Formatted lower tole- ran ce	0066	F32	RW	Formatted probe position (see below)
Multiplying factor	0068	32	RW	
64 bits formatted preset value	0100	F64	RW	Formatted probe position (see below)
64 bits nominal value for tolerance, formatted	0104	F64	RW	Formatted probe position (see below)
Resolution	0120	16	RW	0: 0.1um 1: 1um 2: 10um 3: 100um 4: 0.5um 5: 5um 6: 0.1um rapid read 7: 1um rapid rea d
Probe calibration consta nt	0160	F32	RW	

Type of probe	0164	32	RW	Bit 0: probe P10 Bit 1: probe P25 Bit 2: probe P50 Bit 3: probe P5 or P2 Other bits reserved for future use
Tolerance statuses	0165	16	RO	• Bit 0: Active tolerances • Bit 1: Outside tolerances, reject B it 2: Outside tolerances, rework Bi t 3: Within tolerances • Bit 5: Probe error • Bit 6: External tolerances Bit 7: In ternal tolerances • Bit 8: Outside Min/Max tolerances, reject • Bit 9: Outside Min/Max tolerances, rework • Bit 10: Within Min/Max tolerance s • Other bits reserved for future use
Formatted probe posi- ti ons of correction pp	0240	26xF32	RO	Formatted probe position but without Preset (see below)
Formatted probe correc- tions of correction pp	0300	26xF32	RO	Formatted probe position (see below)

Point number for correc- tion pp access	0360	16	RW	0 .. max 25
Correction pp value	0362	F32	RW	Formatted probe position (see below). A single access is allowed after writing the point number @ word address 0360

Last correction pp error	0364	16	RW	0 : No error 1 : Invalid point 2 : Invalid correction 4 : Non monotonic 5 : Invalid probe type 7 : Invalid resolution 8 : Empty correction pp 9 : Invalid command 10 : Unstabilisated temperature
Correction point number	0380	16	WO	0…25
Correction point abciss	0382	F32	R/W	Formatted probe position (see below)
Correction point delta	0384	F32	R/W	Formatted probe position (see below)
Date of last pp correction	0390	32	RW	32 bit coded date format (see below)
Date of next pp correction	0392	32	RW	32 bit coded date format (see below)
Access to bits 0064-0127	0400	4×16	RW	See corresponding bits (probe A)
Sum of probes 1 and 2 (P1 + P2)	8100	F32	RO	Formatted probe position (see below)
Difference of probes 1 and 2 (P1 – P2)	8102	F32	RO	Formatted probe position (see below)
Mean of probes 1 and 2 (½ P1 + ½ P2)	8104	F32	RO	Formatted probe position (see below)
Sum of probes 1, 2 and 3 (P1 + P2 + P3)	8106	F32	RO	Formatted probe position (see below)
Mean of probes 1, 2 and 3 (1/3 P1 + 1/3 P2 + 1/3 P3)	8108	F32	RO	Formatted probe position (see below)
Sum of probes 1, 2, 3 and 4 (P1 + P2 + P3 + P4)	8110	F32	RO	Formatted probe position (see below)

Mean of probes 1, 2, 3 and 4 (¼ P1 + ¼ P2 + ¼ P3 + ¼ P4)	8112	F32	RO	Formatted probe position (see below)
Last module error	8116	16		• 0: no error • 1: Critical memory • 2: Non-critical memory • 3: RS232 hardware • 4: RS232 software • 5: RS485 hardware • 6: RS485 software • 7: RS485 collision • 8: Probe error

Last module error	8117	16		0: no error 1: Incorrect 32 bit access 2: Incorrect address 3: Inactive function 4: Invalid value 5: Undefined probe 6: Empty variable 7: Invalid configuration 8: Protected variable
64 bits sum of probes 1 and 2 (P1 + P2)	8148	F32	RO	Formatted probe position (see below)
64 bits difference of probes 1 and 2 (P1 – P2)	8152	F32	RO	Formatted probe position (see below)
64 bits mean of probes 1 and 2 (½ P1 + ½ P2)	8156	F32	RO	Formatted probe position (see below)
64 bits sum of probes 1, 2 and 3 (P1 + P2 + P3)	8160	F32	RO	Formatted probe position (see below)

64 bits mean of probes 1 , 2 and 3 (1/3 P1 + 1/3 P2 + 1/3 P3)	8164	F32	RO	Formatted probe position (see below)
64 bits sum of probes 1, 2, 3 and 4 (P1 + P2 + P3 + P4)	8168	F32	RO	Formatted probe position (see below)
64 bits mean of probes 1 , 2, 3 and 4 (¼ P1 + ¼ P2 + ¼ P3 + ¼ P4)	8172	F32	RO	Formatted probe position (see below)
Date of last calibration	8200	32	RW	32 bit coded date format (see below)
Date of next calibration	8202	32	RW	32 bit coded date format (see below)
Software version	8450	32	RO	32 bit coded version format (see bel ow)
Software version date	8452	32	RO	32 bit coded date format (see below)
Foot switch function	8700	16	RW	• 1: Print • 2: Zero Preset • 3: Preset • 4: Preset & Print • 5: Reset min/max/delta to 0 6: Da ta out on/off

Selection of channels for the foot switch function	8701	16	RW	• 0: all • 1: channel 1 • 2: channel 2 • 3 : channel 3 • 4 : channel 4 • 5 : channels 1+2 • 6 : channels 3+4 • 7: one after the other
Module user number	8702	16	RW	0..9999
RS485/ Modbus port tra nsmission speed	8703	16	RW	Transmission speed format (see bel ow)
USB/ RS232 port trans-mission speed	8704	16	RW	Transmission speed format (see bel ow)

Module slave number	8705	16	R(W)	1..247 (0= unconfigured module) (W riting only possible by configuration procedure)
Project number	8950	16	RO	286
Type of module	8951	6×8	RO	D302 or D304 or D302A or D304A
Access to bits 9024-9535	9256	16×16	RW*	See corresponding bits
Access to bits 9536-9791	9288	16×16	RW	See corresponding bits
Module serial number	9600	12×8	RO	ASCII character string

VARIABLES FORMATS

32 bit probe position format (F32)

- Bits 7..0: Day (1-31)
- Bits 15..8: Month (1-12)
- Bits 31..16: Year (2000-2099)
- 00.00.0000: Indeterminate date

32 bit coded version format

- Bits 7..0: Major ASCII version
- Bits 15..8: Minor ASCII version in tens
- Bits 23..16: Minor ASCII version in units

- Bits 31..24: ASCII letter or space

Transmission speed format

- 0: 4,800 bauds 1: 9,600 bauds 2: 19,200 bauds
- 3: 38,400 bauds 4: 56,000 bauds 5: 57,600 bauds
- 6: 76,800 bauds 7: 115,200 bauds 8: 128,000 bauds
- 9: 187,500 bauds 10: 230,400 bauds 11: 256,000 bauds

A.6 MODBUS exceptions codes

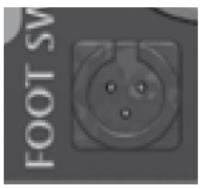
Exception code	Description
01	Illegal function
02	Illegal address
03	Illegal data
04	Slave failure

Port RS-485, configuration parameters

Baud rate	4’800…256’000 bds (transmission speed, default = 128’000 bds)
Parity	Even
Data Bits	8
Stop bits	1
Flow Control	None
RS-485 bus load	1/32 (max 32 modules on the RS-485 bus link)

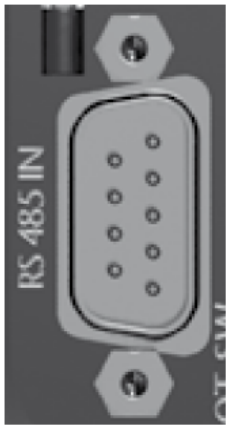
A.7 Connectors functions

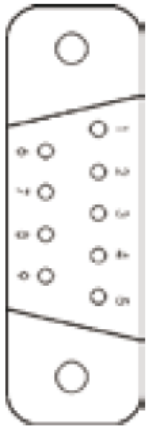
Pin 1	Ground
Pin 2	Input + 8.5 V
Pin 3	External contact input (active signal = 0 Volt)



Pin 1	Ground
Pin 2	Input + 8.5 V
Pin 3	External contact input (active signal = 0 Volt)

RS 485 IN





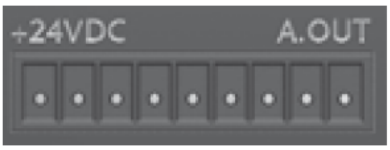
Pin 1	Negative Modbus signal (RS-485 B wire)
Pin 2	Not used
Pin 3	Not used
Pin 4	Positive Modbus signal (RS-485 A wire)
Pin 5	Ground (0 volt)
Pin 6	Power supply 8..24VDC
Pin 7	Not used
Pin 8	External contact signal, negative RS-485
pin 9	External contact signal, positive RS-485

RS 485 OUT

Pin 1	Negative Modbus signal (RS-485 B wire)
Pin 2	Not used
Pin 3	Not used
Pin 4	Positive Modbus signal (RS-485 A wire)
Pin 5	Ground (0 volt)
Pin 6	Power supply 8..24VDC
Pin 7	Not used
Pin 8	External contact signal, negative RS-485 (RS-485 B wire)
Pin 9	External contact signal, positive RS-485 (RS-485 A wire)

Connector block

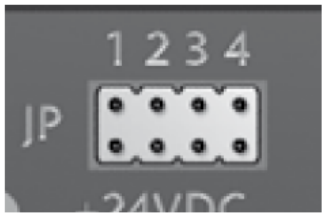
1 **7**



1 **9**

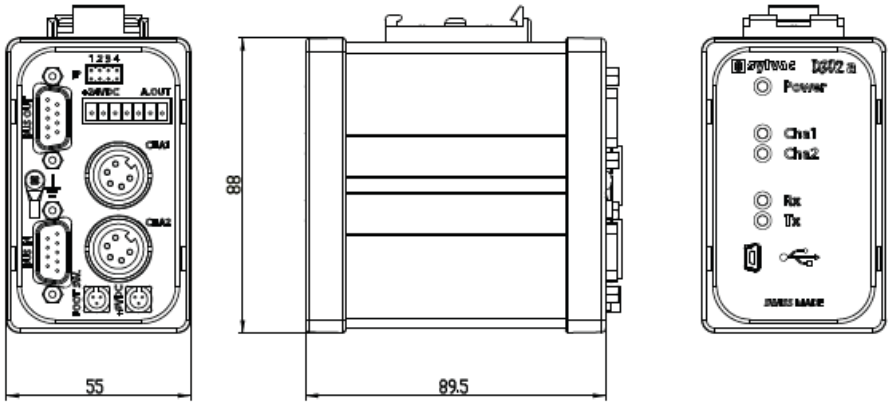
	D302y	D304y	
	Pin 1	Pin 1	Ground (0 volt)
	Pin 2	Pin 2	Power supply +24VDC
	Pin 3	Pin 3	Shield (wiring of the shielding of the power supply cable)
		Pin 4	Analog output 4 (option D304a)
		Pin 5	Analog output 3 (option D304a)
	Pin 4	Pin 6	Analog output 2 (option D30Xa)
	Pin 5	Pin 7	Analog output 1 (option D30Xa)
	Pin 6	Pin 8	Analog ground (0 volt)
	Pin 7	Pin 9	Shield (wiring of the shielding of the analog cable)

Jumpers

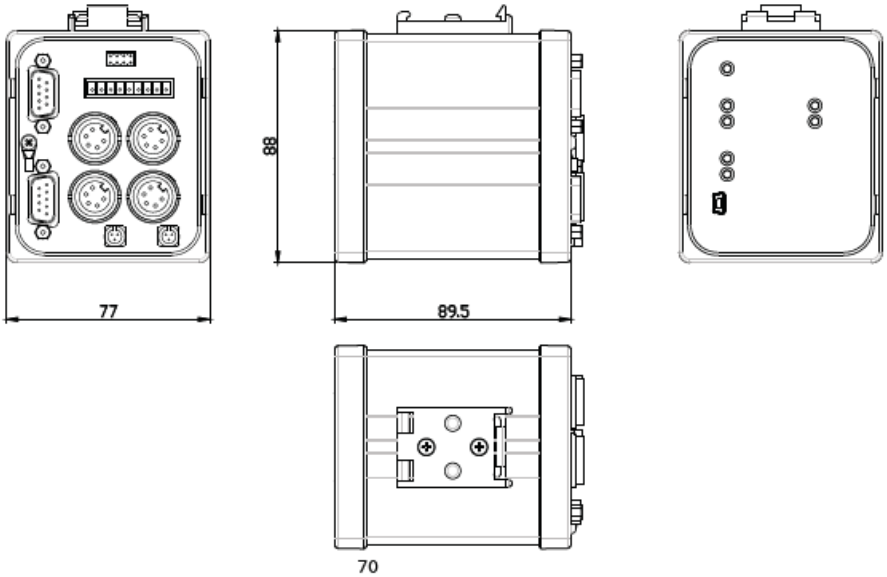
	J1 and J2	With jumper, accepts the actions of external contact of previous module
	J3	With jumper, accepts the power supply from the previous module (Max 4 chained modules powered from one Sylvac charger, max 8 chained modules powered from +24VDC)
	J4	With jumper, activates the line termination resistor (150 ohms)

Overall and fixture

D302
D302A



D304
D304A



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Changes without prior notice
Edition 2015/03 – Manuel D302y/D304y EFDIS 681.286.02-100

Documents / Resources

	Sylvac D302 Conversion Module for Sylvac Probes [pdf] Instruction Manual D302, D302a, D304, D304a, D302 Conversion Module for Sylvac Probes, D302, Conversion Module for Sylvac Probes, Module for Sylvac Probes, for Sylvac Probes, Sylvac Probes, Probes

References

- User Manual