Swiss manufacturer of precision measuring instruments since 1969

Conversion module for Sylvac probes
Module de conversion pour palpeurs Sylvac
Wandler-Einheit für Sylvac Messtaster
Modulo di conversione per sensori Sylvac
Conversión del módulo de sensores Sylvac

D302 / D302a
D304 / D304a



OPERATING INSTRUCTIONS
MANUEL D'UTILISATION
BEDIENUNGS-ANLEITUNG
MANUALE D'UTILIZZO
MANUAL D'UTILIZACIÓN

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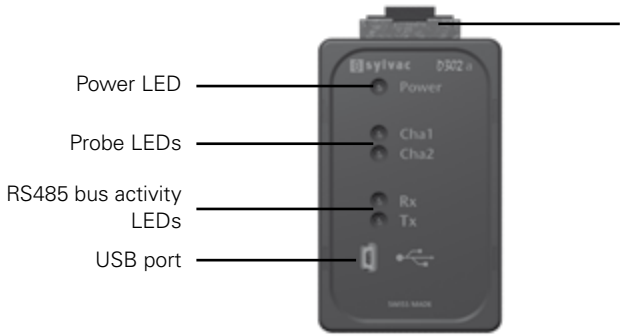
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1. General description

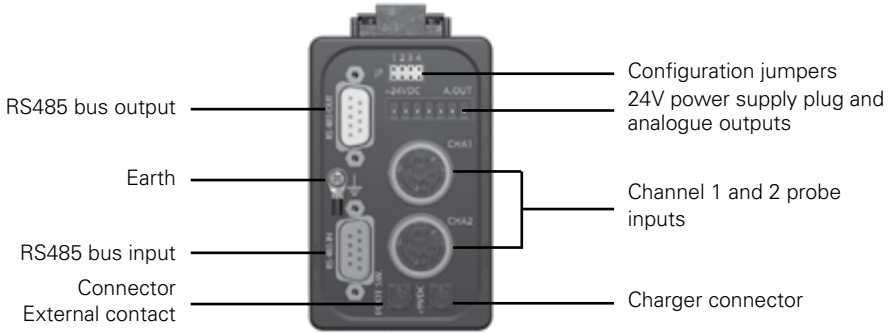
The **D302** module is used to read and convert the value of the position of the two Sylvac probes up to a resolution of 0.1µm. The results are available on a USB port and on a MODBUS RS485 port. Numerous other integrated functions can be used to solve most measuring problems encountered.

The **D302a** module is fitted with an extension which is used to supply analogue voltages corresponding 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.

1.1 Front



1.2 Back



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

2. 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.

3. Indicators

3.1 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.

3.2 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.

3.3 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.

4. Calibration

4.1 Module calibration

Module calibration consists of entering 2 reference points along the path of the probe and specifying 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.

4.2 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**.

Calibration procedure (cont.)

- 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 during the reading procedure.
- 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.

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4.3 Diameter measurement calibration

The module can be calibrated to measure internal diameters thanks to the **CALi** remote command: **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.

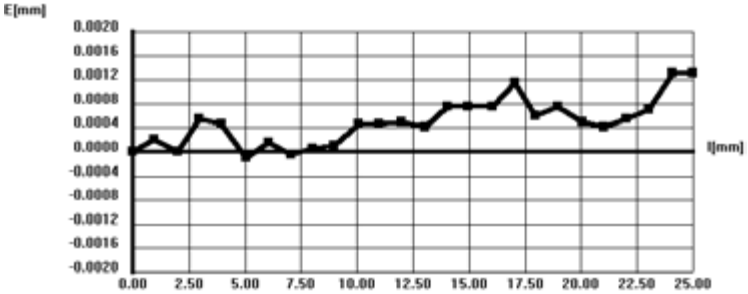
4.4 Pairing a probe and a conversion module

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 correction 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.

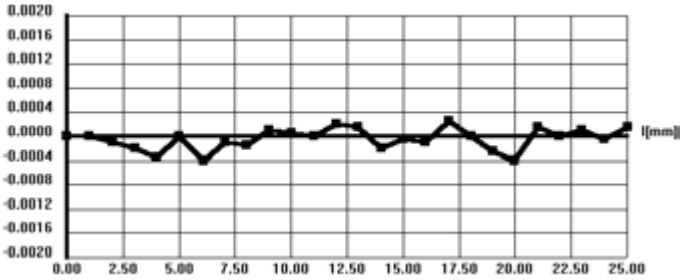
For an optimum result it is advisable to perform correction point by point when the module is in a state of perfect thermal stabilisation, i.e. at least 2 hours after being powered up. If the module is not thermally stabilised point by point correction is not possible. The module returns **TEMP.ERR**.

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 between 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).

4.5 Analogue module calibration (D30Xa only)

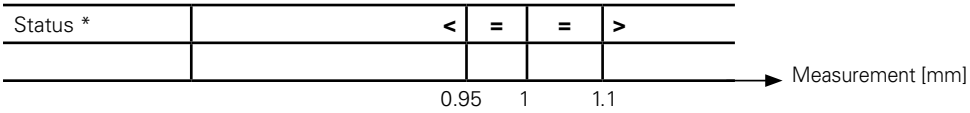
The **D30Xa** analog modules are calibrated in the factory with a P25 reference sensor. This factory calibration may not be modified. However, the user can modify the initial reference and the range of each analogue output thanks to the remote commands **AREF** and**AVMM** or **AVIN** (see the remote 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.

5. 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 precedence over the OK tolerance sign). See also remote controls **TOLM ? and TOLS ?**

6. Min/Max/Delta function

The module can be configured to search for minimum and maximum values (see remote commands **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.

7. Customised read out

7.1. 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**).

7.2. 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.

8. 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.

8.1 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)

9. 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 mandatory otherwise the command is not executed.

Example: **COR F1 RST**.

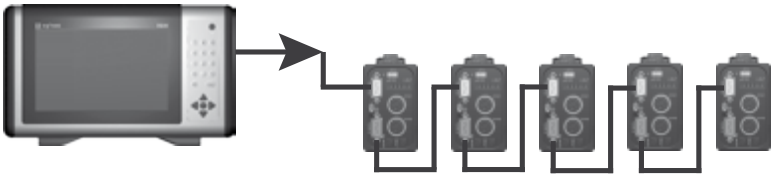
See the attached table of remote commands.

10. 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 controller) 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).

10.1 Architecture



10.2 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.

10.3 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 configured with a unique bus address.

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10.3.1 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.

10.3.2 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 953

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

11. 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.

12. 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 actuation	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	0.1µm: 25/s (1 channel), 12/s (n channels) 1µm: 35/s (1 channel), 20/s (n channels)
Customised reading mode	Up to 100/s (1 channel), 80/s (n channels)
Resolution of analogue outputs (D30Xa only)	0.025mV

13. Packaging details

See our catalogue or website www.sylvac.ch

A. 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 specified 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 : local 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 <, >, =]

A

PRINT ?	Returns status of all print options Option TXT : Adds spaces to align output values (default ON) Option XLS : Adds a space 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 OFF) 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, Tolerance B (+/- 400mm/15")) Signs are recommended. Tolérance A > tolérance B : External measurement Tolérance A < tolérance B : Internal 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

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

ADU (Application Data Unit)

PDU (Protocole Data Unit)

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 new 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 (vvvv = 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 Bit 3 : Slave configuration error
08 04	Listen only	0x08 0x04 0x0000	(No response)
08 10	Clears all diagnostic registers	0x08 0x0A 0x0000	0x08 0x0A 0x0000
08 11	Reads bus messages counter	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 counter	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 slave 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.
- ROΔ 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 tolerances	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 per 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/off	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 seconds	9027	1	R/W*	
Configuration procedure starts (see Module Modbus address 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 (decimal)	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 2^0 resolution Bit 4: Bit 2^1 resolution Bit 5: Bit 2^2 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	ROΔ	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. value	0036	F64	RO	Formatted probe position (see below)
64 bits formatted max. value	0040	F64	RO	Formatted probe position (see below)
Access to bits 0000-0031	0056	2x16	RW	See corresponding bits (probe A)
Formatted Preset value	0060	F32	RW	Formatted probe position (see below)
Nominal value for tolerance, formatted.	0062	F32	RW	Formatted probe position (see below)
Formatted upper tolerance	0064	F32	RW	Formatted probe position (see below)
Formatted lower tolerance	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	
Probe calibration constant	0160	F32	RW	
Type of probe	0164	32	RW	
Tolerance statuses	0165	16	RO	Formatted probe position but without Preset (see below)
Formatted probe positions of correction pp	0240	26xF32	RO	
Formatted probe corrections of correction pp	0300	26xF32	RO	Formatted probe position (see below)

Bit 1: Outside tolerances, reject
Bit 2: Outside tolerances, rework
Bit 3: Within tolerances
Bit 4: Probe error
Bit 5: probe P5 or P2
Bit 6: External tolerances
Bit 7: Internal tolerances
Other bits reserved for future use

1: 1µm
2: 10µm
3: 100µm
4: 1mm
5: 1/2 inch
6: 1/4 inch
7: 1µm rapid read

Bit 1: probe P25
Bit 0: probe P10

Bit 9: Outside Min/Max tolerances, rework
Bit 10: Within Min/Max tolerances
Other bits reserved for future use

A

Point number for correction 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	4x16	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

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 below)
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: Data 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

A

Module slave number	8705	16	R(W)	1..247 (0= unconfigured module) (Writing only possible by configuration procedure)
Project number	8950	16	RO	286
Type of module	8951	6x8	RO	D302 or D304 or D302A or D304A
Access to bits 9024-9535	9256	16x16	RW*	See corresponding bits
Access to bits 9536-9791	9288	16x16	RW	See corresponding bits
Module serial number	9600	12x8	RO	ASCII character string

VARIABLES FORMATS

32 bit probe position format (**F32**)
Bits 31..0: Floating point number coded according to IEEE754

64 bit probe position format (**F64**)
Bits 0..63 : Double floating point number

Formatted probe position format (**F32** or **F64**)
The format of the float value depends of :
Bits 0064…0127 (for probe A)
Words 0060=Preset (when applicable) and 0068=Multiplying factor (for probe A)

32 bit coded date format

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

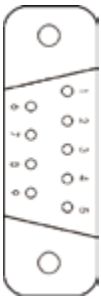
Bits 7..0:	Major ASCII version
Bits 15..8:	Minor ASCII version in tens
Bits 23..16:	Minor ASCII version in units
Bits 31..24:	ASCII letter or space

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

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

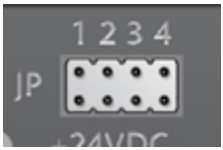




	D302y	D304y	
	Pin 1	Pin 1	Ground (0 volt)
	Pin 2	Pin 2	Power supply +24VDC
	Pin 3	Pin 3	Shield (wiring of the shielding of the power supply cable)
		Pin 4	Analog output 4 (option D304a)
		Pin 5	Analog output 3 (option D304a)
	Pin 4	Pin 6	Analog output 2 (option D30Xa)
	Pin 5	Pin 7	Analog output 1 (option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

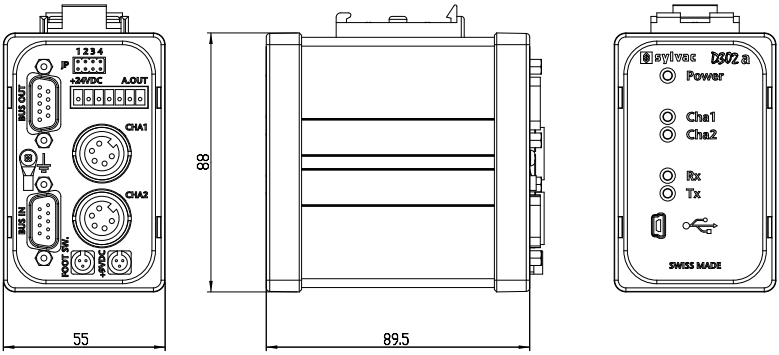
A

Jumpers

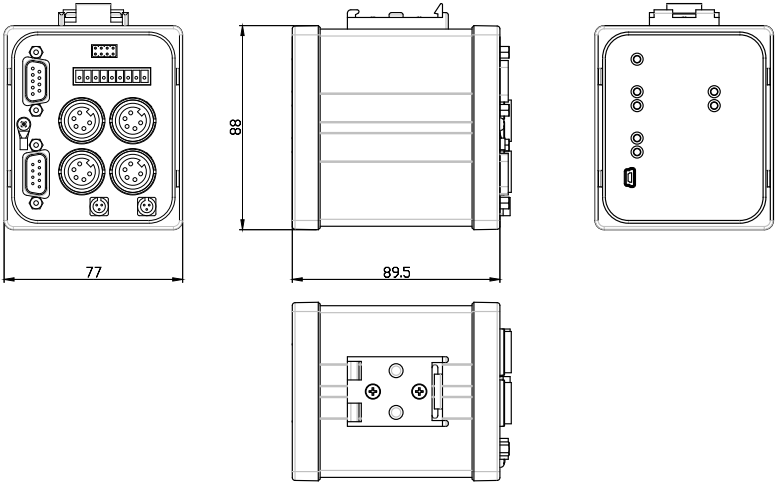
	J1 and J2	With jumper, accepts the actions of external contact of previous module
	J3	With jumper, accepts the power supply from the previous module (Max 4 chained modules powered from one Sylvac charger, max 8 chained modules powered from +24VDC)
	J4	With jumper, activates the line termination resistor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

A.8 Overall and fixture

D302
D302A



D304



A

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EU DECLARATION OF CONFORMITY

We, Sylvac SA, hereby declare under our sole responsibility that the product

Name	D302 Family
Description	Multiplexer unit D302, D304
Part Numbers	804.1302, 804.1303, 804.1304, 804.1305

has been submitted to a conformity assessment and fulfils the essential requirements of the following European directives

2001/95/EC	General product safety
2014/30/EU	EMC
2011/65/EU & 2015/863/EU	RoHS

and complies with the following harmonized standards or other normative documents

EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control and laboratory use
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Person authorized to compile the technical file and issue the declaration of conformity: Eric Schnyder

Place and date of issue	Yverdon-Les-Bains, September 12, 2019
Name (position)	Eric Schnyder (CEO)
Signature	