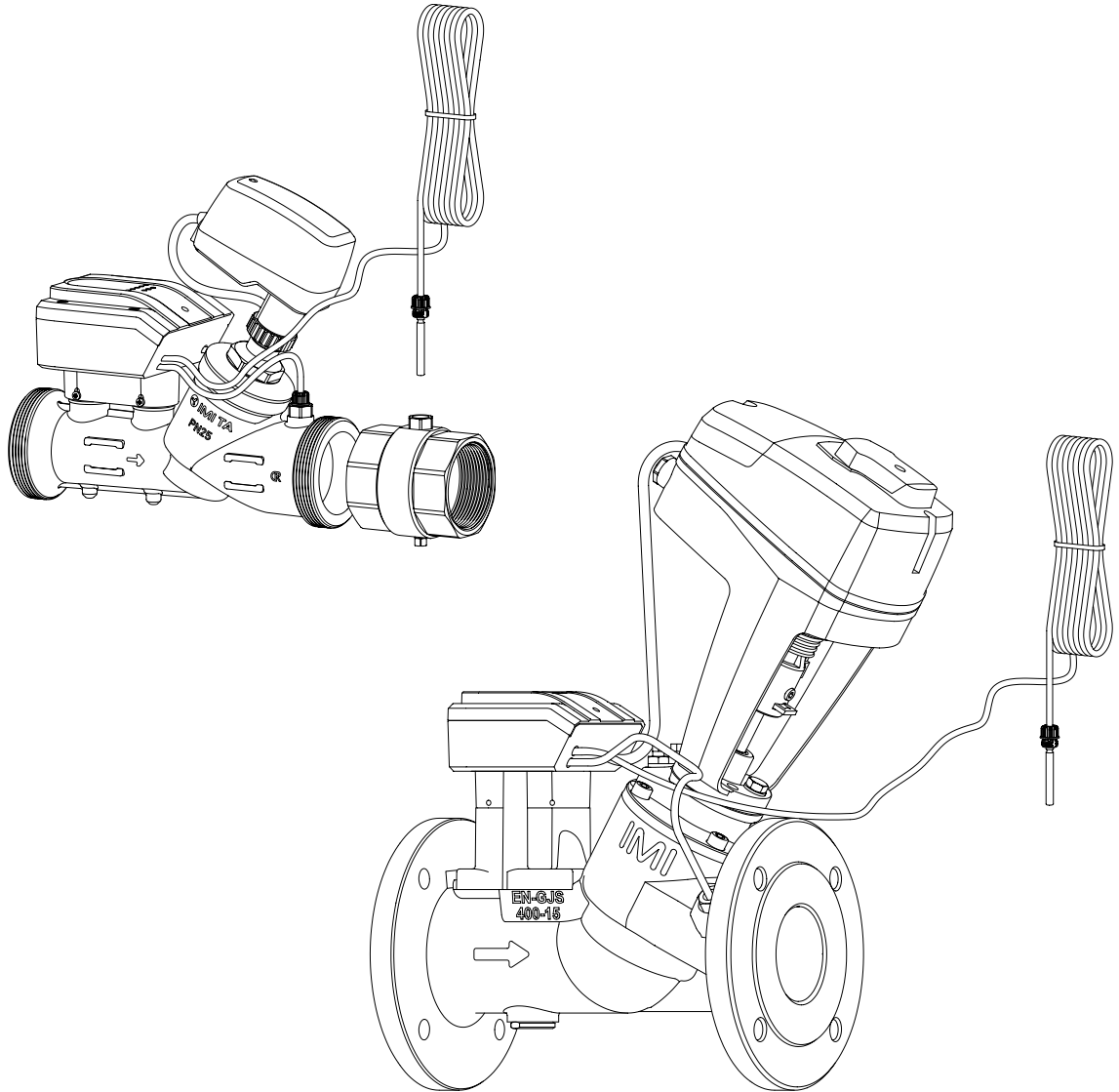


# TA-Smart Modbus RTU Protocol Implementation



## General information

Date:	18/11/2021
Protocol:	Modbus RTU
Product Name:	TA-Smart DN 32 to 80
Product Model Number:	322231-XXXXX
Product Description:	Digitally configurable connected 2-way control valve with integrated ultrasonic flow measurement
Firmware Revision (Modbus RTU):	1.0.0
Address:	1* to 247
Baud rates:	AutoDetect, 1200, 2400, 4800, 9600*, 19200, 38400, 57600, 76800, 115200
Parity:	Odd, Even*, None
Databits:	8
Stopbit:	1

\*) *Default value*

## Modbus registers (pages 2-5)

Register	Address	Data type	Access	Unit	Value range	Default	Description
ValveFamily	0	Word	R	n.a.	1: TA-Smart	n.a.	Family to which the valve belongs
ValveVersion	1	Word	R	n.a.	1: Standard	n.a.	Version of the valve
ValveSize	2	Word	R	n.a.	3: DN20 - 3/4" 4: DN25 - 1" 5: DN32 - 1 1/4" 6: DN40 - 1 1/2" 7: DN50 - 2" 8: DN65 - 2 1/2" 9: DN80 - 3" 10: DN100 - 4" 11: DN125 - 5"	n.a.	Size of the valve
ValveNominalFlow_unit1	3-4	Float	R	FlowUnit1	[0.0, 3.4e+38]	n.a.	Nominal flow of the valve expressed in the units selected in registers FlowUnit1 and FlowUnit2 respectively. This is the maximum value of flow that can be assigned to the valve.
ValveNominalFlow_unit2	5-6	Float	R	FlowUnit2	[0.0, 3.4e+38]	n.a.	
ValveMinAdjustableFlow_unit1	7-8	Float	R	FlowUnit1	[0.0, 3.4e+38]	n.a.	Min adjustable flow of the valve expressed in the units selected in registers FlowUnit1 and FlowUnit2 respectively. This is the minimum value of flow that can be assigned to the valve.
ValveMinAdjustableFlow_unit2	9-10	Float	R	FlowUnit2	[0.0, 3.4e+38]	n.a.	
ValveNominalPower_unit1	11-12	Float	R	PowerUnit1	[0.0, 3.4e+38]	n.a.	Nominal power of the valve expressed in the units selected in registers PowerUnit1 and PowerUnit2 respectively. This is the maximum value of power that can be assigned to the valve.
ValveNominalPower_unit2	13-14	Float	R	PowerUnit2	[0.0, 3.4e+38]	n.a.	
ValveMinAdjustablePower_unit1	15-16	Float	R	PowerUnit1	[0.0, 3.4e+38]	n.a.	Min adjustable power of the valve expressed in the units selected in registers PowerUnit1 and PowerUnit2 respectively. This is the minimum value of power that can be assigned to the valve.
ValveMinAdjustablePower_unit2	17-18	Float	R	PowerUnit2	[0.0, 3.4e+38]	n.a.	
ValveNominalStroke_mm	19-20	Float	R	mm	[0.0, 3.4e+38]	n.a.	Nominal stroke of the valve expressed in millimeters and inches respectively.
ValveNominalStroke_inch	21-22	Float	R	inch	[0.0, 3.4e+38]	n.a.	
ValveMinAdjustableStroke_mm	23-24	Float	R	mm	[0.0, 3.4e+38]	n.a.	Min adjustable stroke of the valve expressed in millimeters and inches respectively. This is the minimum value of limited stroke that can be assigned to the valve.
ValveMinAdjustableStroke_inch	25-26	Float	R	inch	[0.0, 3.4e+38]	n.a.	
ValveIdentifier	100-101	4 bytes	R	n.a.	n.a.	n.a.	Valve identifier, the hexadecimal representation of this variable is a reference that can be seen on the PCBA and in the Bluetooth advertisement of the valve.
ValveUserID	102-117	String	R/W	n.a.	n.a.	n.a.	Editable alphanumeric chain (32 chars) that can be used to label the valve
FirmwareVersion	118-119	4 bytes	R	n.a.	n.a.	n.a.	Installed version of the firmware a.b.c.d where: (a) High byte of register 118 is the BT840 firmware compatibility number (b) Low byte of register 118 is the App compatibility number (c) High byte of register 119 is the major version number of the firmware (d) Low byte of register 119 is the minor version number of the firmware
FluidType	120	Word	R/W	n.a.	0: Water 1: Monoethylene glycol 2: Monopropylene glycol	0	Type of the fluid. It can be either water or one of the listed additives diluted in water

Register	Address	Data type	Access	Unit	Value range	Default	Description
FlowSide	121	Word	R/W	n.a.	0: Supply side 1: Return side	0	Piping side on which the valve is installed (supply or return)
ControlMode	122	Word	R/W	n.a.	1: Flow control 2: Power control 4: Position control	1	The control mode indicates which variable is being controlled by the valve
ControlCharacteristics	123	Word	R/W	n.a.	0: Linear 1: Equal-percentage (EQM) 2: Inverted EQM	1	Signal characteristics applied to the setpoint value given in register RelativeSetpoint into a target value for the controlled variable. When control mode is set to flow control, the chosen characteristics should be selected as EQM and Linear in the other cases.
ControlCharCoefficient	124-125	Float	R/W	n.a.	[0.01, 0.99]	0.25	This coefficient (thermal efficiency) allows to adjust the curvature of the EQM and Inverted EQM characteristics. Default value is 0.25.
ControlSource	126	Word	R/W	n.a.	0: Analog 1: Bus	0	Control source specifies whether the setpoint for controlling the valve is provided by the analog input (in which case bus is used just for monitoring) or by the bus
AnalogSignalType	127	Word	R	n.a.	0: Voltage (VDC) 1: Current (mA)	0	Defines the type of analog input signal as set by jumper inside the SmartBox
FlowUnit1	128	Word	R/W	n.a.	0: m <sup>3</sup> /h 1: l/s 2: l/min 3: l/h 4: GPM	0	First selected flow unit
FlowUnit2	129	Word	R/W	n.a.	0: m <sup>3</sup> /h 1: l/s 2: l/min 3: l/h 4: GPM	4	Second selected flow unit
PowerUnit1	130	Word	R/W	n.a.	0: kW 1: W 2: Btu/h 3: kBtu/h 4: ton (refrig.)	0	First selected power unit
PowerUnit2	131	Word	R/W	n.a.	0: kW 1: W 2: Btu/h 3: kBtu/h 4: ton (refrig.)	3	Second selected power unit
EnergyUnit1	132	Word	R/W	n.a.	0: kWh 1: kJ 2: MJ 3: kBtu 4: MBtu 5: ton.h	0	First selected energy unit
EnergyUnit2	133	Word	R/W	n.a.	0: kWh 1: kJ 2: MJ 3: kBtu 4: MBtu 5: ton.h	4	Second selected energy unit
RegimeSwitching	200	Word	R	n.a.	0: None 1: Dual-range input signal 2: Bus 3: Temperature detection 4: Scheduling	0	Switching mode between regimes 1 and 2. To be changed by configuration with the HyTune app. When None, values input for regime 1 are used.
CurrentRegime	201	Word	R/W	n.a.	0: Regime1 1: Regime2 2: Regime1Setback 3: Regime2Setback	0	Current change-over regime. Changing the current change-over regime via Modbus can be done only if register RegimeSwitching is set to 2.
R1SetbackPercentage	202-203	Float	R/W	%	[0.0, 100.0]	100.0	Setback percentage applied to MaxFlow-Regime1 when CurrentRegime is set to Regime1Setback
R2SetbackPercentage	204-205	Float	R/W	%	[0.0, 100.0]	100.0	Setback percentage applied to MaxFlow-Regime2 when CurrentRegime is set to Regime2Setback
MaxFlowRegime1_unit1	206-207	Float	R/W	FlowUnit1	[ValveMinAdjustable-Flow_unit1, ValveNominalFlow_unit1]	ValveNominal-Flow_unit1	Max flow assigned to the valve when the valve is in regime 1
MaxFlowRegime1_unit2	208-209	Float	R/W	FlowUnit2	[ValveMinAdjustable-Flow_unit2, ValveNominalFlow_unit2]	ValveNominal-Flow_unit2	
MaxFlowRegime2_unit1	210-211	Float	R/W	FlowUnit1	[ValveMinAdjustable-Flow_unit1, ValveNominalFlow_unit1]	ValveNominal-Flow_unit1	Max flow assigned to the valve when the valve is in regime 2
MaxFlowRegime2_unit2	212-213	Float	R/W	FlowUnit2	[ValveMinAdjustable-Flow_unit2, ValveNominalFlow_unit2]	ValveNominal-Flow_unit2	
MinFlowRegime1_unit1	214-215	Float	R/W	FlowUnit1	[0.0, MaxFlowRegime1_unit1]	0.0	Min flow assigned to the valve when the valve is in regime 1
MinFlowRegime1_unit2	216-217	Float	R/W	FlowUnit2	[0.0, MaxFlowRegime1_unit2]	0.0	

Register	Address	Data type	Access	Unit	Value range	Default	Description
MinFlowRegime2_unit1	218-219	Float	R/W	FlowUnit1	[0.0, MaxFlowRegime2_unit1]	0.0	Min flow assigned to the valve when the valve is in regime 2
MinFlowRegime2_unit2	220-221	Float	R/W	FlowUnit2	[0.0, MaxFlowRegime2_unit2]	0.0	
MaxPowerRegime1_unit1	222-223	Float	R/W	PowerUnit1	[ValveMinAdjustablePower_unit1, ValveNominalPower_unit1]	ValveNominalPower_unit1	Max power assigned to the valve when the valve is in regime 1
MaxPowerRegime1_unit2	224-225	Float	R/W	PowerUnit2	[ValveMinAdjustablePower_unit2, ValveNominalPower_unit2]	ValveNominalPower_unit2	
MaxPowerRegime2_unit1	226-227	Float	R/W	PowerUnit1	[ValveMinAdjustablePower_unit1, ValveNominalPower_unit1]	ValveNominalPower_unit1	Max power assigned to the valve when the valve is in regime 2
MaxPowerRegime2_unit2	228-229	Float	R/W	PowerUnit2	[ValveMinAdjustablePower_unit2, ValveNominalPower_unit2]	ValveNominalPower_unit2	
MaxPositionRegime1_mm	230-231	Float	R/W	mm	[ValveMinAdjustableStroke_mm, ValveNominalStroke_mm]	ValveNominalStroke_mm	Max position assigned to the valve when the valve is in regime 1
MaxPositionRegime1_inch	232-233	Float	R/W	inch	[ValveMinAdjustableStroke_inch, ValveNominalStroke_inch]	ValveNominalStroke_inch	
MaxPositionRegime2_mm	234-235	Float	R/W	mm	[ValveMinAdjustableStroke_mm, ValveNominalStroke_mm]	ValveNominalStroke_mm	Max position assigned to the valve when the valve is in regime 2
MaxPositionRegime2_inch	236-237	Float	R/W	inch	[ValveMinAdjustableStroke_inch, ValveNominalStroke_inch]	ValveNominalStroke_inch	
MinPositionRegime1_mm	238-239	Float	R/W	mm	[0.0, MaxPositionRegime1_mm]	0.0	Min position assigned to the valve when the valve is in regime 1
MinPositionRegime1_inch	240-241	Float	R/W	inch	[0.0, MaxPositionRegime1_inch]	0.0	
MinPositionRegime2_mm	242-243	Float	R/W	mm	[0.0, MaxPositionRegime2_mm]	0.0	Min position assigned to the valve when the valve is in regime 2
MinPositionRegime2_inch	244-245	Float	R/W	inch	[0.0, MaxPositionRegime2_inch]	0.0	
AnalogSetPointValue	300-301	Float	R	VDC or mA	[0.0, 10.0] for VDC; [0.0, 20.0] for mA	n.a.	Analog input value in VDC or mA used as setpoint for controlling the valve if register ControlSource is set to Analog. Value is VDC or mA depending on register AnalogSignalType
RelativeSetpoint	302-303	Float	R/W	%	[0.0, 100.0]	100.0	Relative setpoint in percentage of currently applicable max value. This setpoint applies if register ControlSource is set to Bus
FlowSetPoint_unit1	304-305	Float	R	FlowUnit1	[0.0, ValveNominalFlow_unit1]	n.a.	Flow setpoint
FlowSetPoint_unit2	306-307	Float	R	FlowUnit2	[0.0, ValveNominalFlow_unit2]	n.a.	
PowerSetPoint_unit1	308-309	Float	R	PowerUnit1	[0.0, ValveNominalPower_unit1]	n.a.	Power setpoint
PowerSetPoint_unit2	310-311	Float	R	PowerUnit2	[0.0, ValveNominalPower_unit2]	n.a.	
PositionSetPoint_mm	312-313	Float	R	mm	[0.0, ValveNominalStroke_mm]	n.a.	Position setpoint
PositionSetPoint_inch	314-315	Float	R	inch	[0.0, ValveNominalStroke_inch]	n.a.	
RelativeMeasuredFlow	316-317	Float	R	%	[0.0, 100.0]	n.a.	Measured flow expressed in percentage of the currently applicable maximum flow depending on register CurrentRegime
MeasuredFlow_unit1	318-319	Float	R	FlowUnit1	[0.0, 3.4e+38]	n.a.	Measured flow
MeasuredFlow_unit2	320-321	Float	R	FlowUnit2	[0.0, 3.4e+38]	n.a.	
MeasuredSupplyTemp_degC	322-323	Float	R	°C	[-40.0, 140.0]	n.a.	Measured supply temperature
MeasuredSupplyTemp_degF	324-325	Float	R	°F	[-40.0, 284.0]	n.a.	
MeasuredReturnTemp_degC	326-327	Float	R	°C	[-40.0, 140.0]	n.a.	Measured return temperature
MeasuredReturnTemp_degF	328-329	Float	R	°F	[-40.0, 284.0]	n.a.	
MeasuredDeltaT_K	330-331	Float	R	K	[0.0, 3.4e+38]	n.a.	Measured DT
MeasuredDeltaT_degF	332-333	Float	R	°F	[0.0, 3.4e+38]	n.a.	
RelativeMeasuredPower	334-335	Float	R	%	[0.0, 100.0]	n.a.	Measured power expressed in percentage of the currently applicable maximum power depending on register CurrentRegime
MeasuredPower_unit1	336-337	Float	R	PowerUnit1	[0.0, 3.4e+38]	n.a.	Measured power
MeasuredPower_unit2	338-339	Float	R	PowerUnit2	[0.0, 3.4e+38]	n.a.	
EnergyCounterRegime1_unit1	340-341	Float	R	EnergyUnit1	[0.0, 3.4e+38]	n.a.	Energy counter in regime 1
EnergyCounterRegime1_unit2	342-343	Float	R	EnergyUnit2	[0.0, 3.4e+38]	n.a.	
EnergyCounterRegime2_unit1	344-345	Float	R	EnergyUnit1	[0.0, 3.4e+38]	n.a.	Energy counter in regime 2
EnergyCounterRegime2_unit2	346-347	Float	R	EnergyUnit2	[0.0, 3.4e+38]	n.a.	
RelativeMeasuredPosition	348-349	Float	R	%	[0.0, 100.0]	n.a.	Measured position expressed in percentage of the currently applicable maximum position depending on register CurrentRegime

Register	Address	Data type	Access	Unit	Value range	Default	Description
MeasuredPosition_mm	350-351	Float	R	mm	[0.0, 3.4e+38]	n.a.	Measured position
MeasuredPosition_inch	352-353	Float	R	inch	[0.0, 3.4e+38]	n.a.	
AdditiveConcentration	354-355	Float	R/W	%	[0.0, 57.0]	0.0	Additive concentration in water in % weight. Additive is defined through register FluidType. Register is not writable if FluidType is Water
OverrideType	400	Word	R/W	n.a.	0: None 1: Flow 2: Power 4: Valve position 5: Stop 6: Simulated operation	0	Type of override defining which action is taken as an override to the configured control. The valve resets automatically to normal operation leaving the override after 3 hours.
OverrideValue_unit1	401-402	Float	R/W		[0.0, 3.4e+38]		Value of the max flow, power or position that applies if register OverrideType is set to 1, 2, 4 or 6. The value is expressed according in selected Unit1 for flow and power and in mm for position
OverrideValue_unit2	403-404	Float	R/W		[0.0, 3.4e+38]		Value of the max flow, power or position that applies if register OverrideType is set to 1, 2, 4 or 6. The value is expressed according in selected Unit2 for flow and power and in inch for position
CurrentErrorState	500-501	Long	R	n.a.	Bit 0 (0x01): 0/1	0	Error 1: ErrorLowPower
					Bit 1 (0x02): 0/1	0	Error 2: ErrorInputLineBroken
					Bit 2 (0x04): 0/1	0	Error 3: WarningFlowNotReached
					Bit 3 (0x08): 0/1	0	Error 4: WarningPowerNotReached
					Bit 4 (0x10): 0/1	0	Error 5: ErrorLocalTempSensorDisconnected
					Bit 5 (0x20): 0/1	0	Error 6: ErrorRemoteTempSensorDisconnected
					Bit 6 (0x40): 0/1	0	Error 7: WarningActuatorManualOverride
					Bit 7 (0x80): 0/1	0	Error 8: ErrorRemoteTempSensorShortCircuit
					Bit 8 (0x100): 0/1	0	Error 9: ErrorLocalTempSensorBelowMin
					Bit 9 (0x200): 0/1	0	Error 10: ErrorRemoteTempSensorBelowMin
					Bit 10 (0x400): 0/1	0	Error 11: ErrorLocalTempSensorAboveMax
					Bit 11 (0x800): 0/1	0	Error 12: ErrorRemoteTempSensorAboveMax
					Bit 14 (0x4000): 0/1	0	Error 15: ErrorFlowMeasurement
					LastErrors[1]	502-503	Long
504-505	4 bytes	R	n.a.			0	First of the last ten errors, see register CurrentErrorState above. Error is cleared if bit 31 is set to 1 (0x80000000)
506-507	Float	R	n.a.	[0.0, 3.4e+38]		0	Value if a data exists for the error
...	...						
LastErrors[10]	556-557	Long	R	n.a.	[0, 2^32]	0	UTC time in seconds since 1st January 2000 00:00 epoch
	558-559	4 bytes	R	n.a.		0	Last of the last ten errors, see register CurrentErrorState above. Error is cleared if bit 31 is set to 1 (0x80000000)
	560-561	Float	R	n.a.	[0.0, 3.4e+38]	0	Value if a data exists for the error
LastEvents[1]	562-563	Long	R	n.a.	[0, 2^32]	0	UTC time in seconds since 1st January 2000 00:00 epoch
	564-565	4 bytes	R	n.a.		0	First of the last ten events, see table Events
	566-567	Float	R	n.a.	[0.0, 3.4e+38]	0	Value if a data exists for the event
...	...						
LastEvents[10]	616-617	Long	R	n.a.	[0, 2^32]	0	UTC time in seconds since 1st January 2000 00:00 epoch
	618-619	4 bytes	R	n.a.		0	Last of the last ten events, see table Events
	620-621	Float	R	n.a.	[0.0, 3.4e+38]	0	Value if a data exists for the event

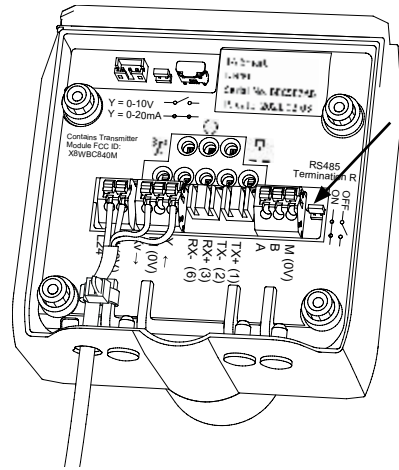
## Event table

Value	Description
0x40000001	EventResetToUserDefault
0x40000002	EventLoginAsAdmin

## RS-485 termination resistance

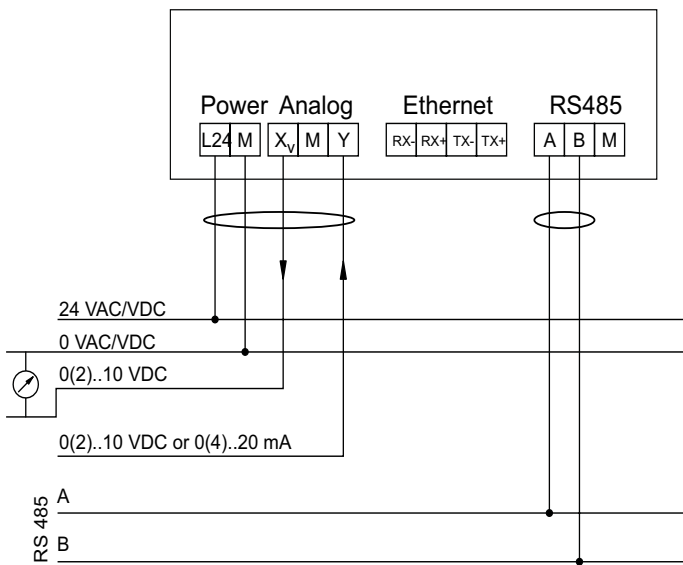
The jumper placed beside the RS-485 A, B and M wire connectors must be closed (set to ON) for activating the 120 Ohm RS-485 termination resistance.

The termination resistance must be activated if TA-Smart is at the end of a daisy chain or if it is not part of a daisy chain.



## Wiring diagram

TA-Smart



### Note:

1. A, B and M terminals are NOT isolated from all other terminals.
2. GND (M - 0V) is common to power supply, analog signals and RS 485.
3. In case of AC power supply, L24 and M should be connected to the same phase for each TA-Smart.
4. GND (0V) of RS 485 should be connected to 0 VAC/VDC on the controller side.
5. GND (0V) of analog input/output should be connected to 0 VAC/VDC on the controller side.