APPLICATION NOTE

AQ-2xx implementing ADAM units

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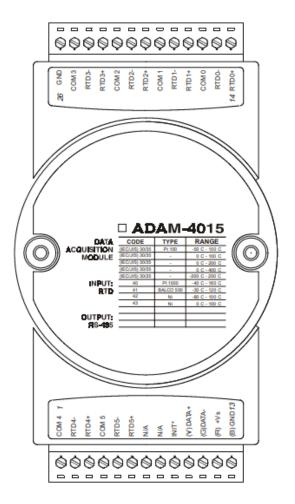
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1 ADAM-4015 6CH RTD MODULE WITH MODBUS

1.1 BASIC TECHNICAL DATA

ADAM-4015 provides six RTD input channels for different types of RTD signal as an effective solution in industrial & building automation. Usually, broken external wiring will lead to inaccurate current value. The ADAM-4015 provides a broken wiring detecting function so users can easily troubleshoot broken wiring problems.



Picture 1: ADAM-4015 6-ch RTD input module

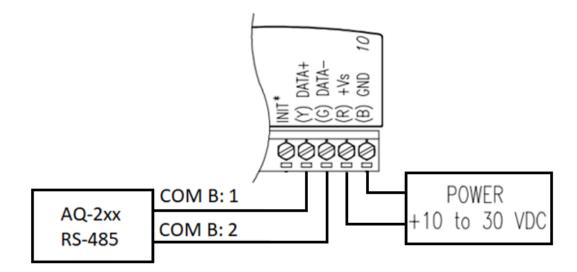
Channel Number	6 differential
Support Protocol	ADAM ASCII and MODBUS/RTU
Input Type	Pt100, Pt1000, BALCO500, Ni
Input Connections	2 or 3 wires
Wire Burnout Detection	Yes
Input Type and Temper- ature Range	Pt100: -50 to 150° C 0 to 100° C 0 to 200° C -200 to 200° C -200 to 200° C Pt1000: -40 to 160° C Balco500: -30 to 120° C Ni 50 RTD: -80 to 100° C Ni 508 RTD: 0 to 100° C
Isolation Voltage	3000 V _{DC}
Sampling Rate	10 sample/second (total)
Input Impedance	10 MΩ
Resolution	16-bit
Accuracy	±0.1% (Typical)
CMR@50/60Hz	120 dB
NMR@50/60Hz	100 dB
Span Drift	± 25 ppm/°C
Zero Drift	± 3 µV/°C
Watchdog Timer	System (1.6 second) and Communication
Power Input	+10~+30 V _{DC} (non-regulated)
Power Consumption	1.2 W @ 24V _{DC}

ADAWI-4015				
RTD type	Temperature Range	Accuracy		
Platinum 100 (IEC)	-50 ~ 150°C 0 ~ 100°C 0 ~ 200°C 0 ~ 400°C -200 ~ 200°C	0.10%		
Platinum 100 (JIS)	-50 ~ 150°C 0 ~ 100°C 0 ~ 200°C 0 ~ 400°C -200 ~ 200°C	0.2% or better		
Platinum 1000	-40 ~ 160°C	0.10%		
BALCO 500	-30 ~ 120°C	0.50%		
Ni 508	-50 ~ 200°C	0.10%		
Ni 604	-80 ~ 100°C 0 ~ 100°C	0.10%		

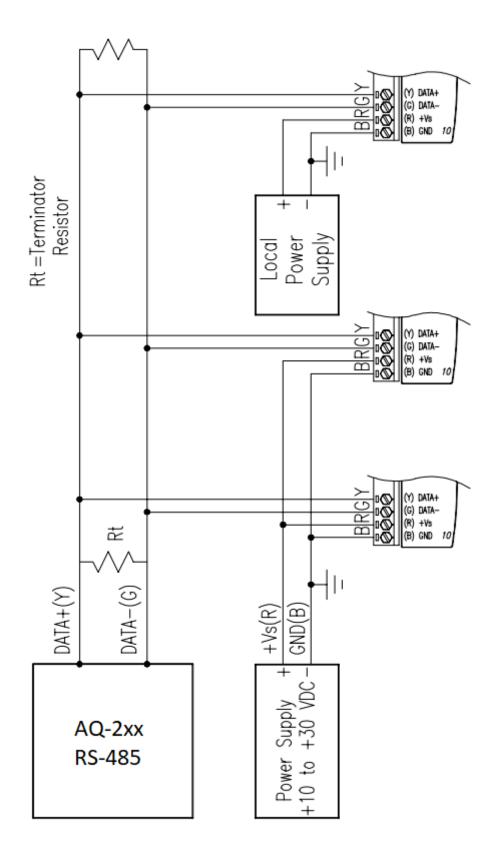
ADAM-4015

Picture 2: Technical specification of ADAM-4015 6-ch RTD input module

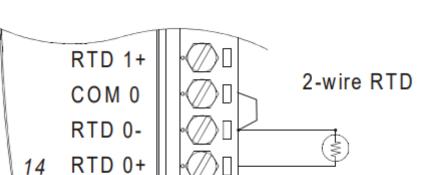
1.2 CONNECTIONS



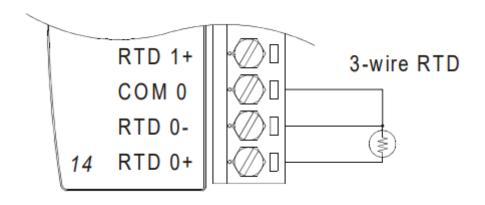
Picture 3: Connecting power supply and RS485 communication to ADAM-4015



Picture 4: Connecting multiple ADAM-4015 units to AQ-2xx



Picture 5: Connecting RTD measurement with 2-wire connection to ADAM-4015

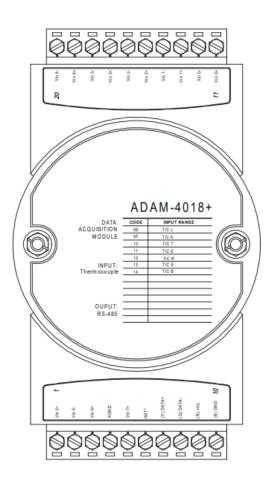


Picture 6: Connecting RTD measurement with 3-wire connection to ADAM-4015

2 ADAM-4018+ 8CH ANALOG MODULE WITH MODBUS

2.1 BASIC TECHNICAL DATA

ADAM-4018+ enables eight differential channels with multiple input types. This multich/multi-type structure allows channels with different input types at the same time, say channel 1 with K input type meanwhile the others with R and S types. ADAM-4018+ is an 8-channel T/C input module. It is rather dedicated to T/C and 4 ~ 20 mA inputs for those with special request. Usually, broken external will lead to inaccurate current value. ADAM-4018+ provides burned-out detection so that users can easily troubleshoot broken wiring problems.

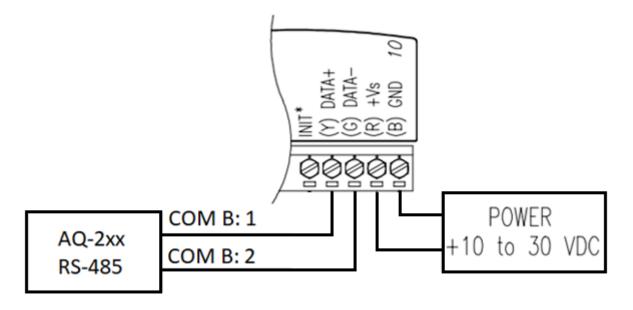


Picture 7: ADAM-4018+ 8-ch thermocouple input module

Channel	8
Input Type T	Thermocouple
Input range and T/C type	±20 mA, 4~20 mA J 0 ~ 760° C K 0 ~ 1370° C T -100 ~ 400° C E 0 ~ 1000° C R 500 ~ 1750° C S 500 ~ 1750° C B 500 ~ 1800° C
Isolation Voltage	3000 V _{DC}
Fault and over-voltage protection	Withstands over voltage up to ±35 V
Sampling Rate	10 sample/sec (total)
Input Impedance	Voltage: 20 MΩ, Current: 120Ω
Accuracy	±0.1% or better
Power Consumption	0.8 W @ 24V _{DC}
I/O Connector Type	10 pin plug-in terminal

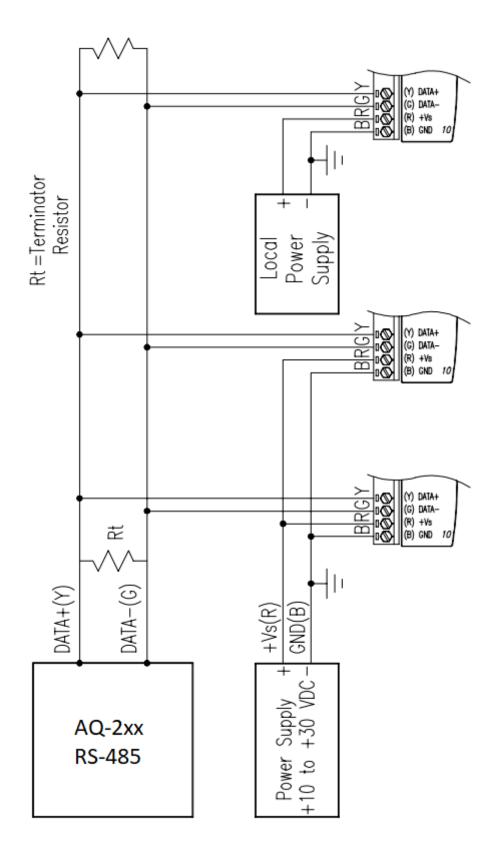
Picture 8: Technical specification of ADAM-4018+ 8-ch thermocouple input module

2.2 CONNECTIONS

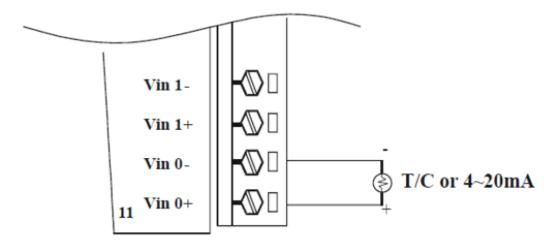


Picture 9: Connecting power supply and RS485 communication to ADAM-4018+

11 (23)



Picture 10: Connecting multiple ADAM-4018+ units to AQ-2xx



Picture 11: Connecting mA or thermocouple measurement to ADAM-4018+

JP0~ JP7		4~20 mA Input Range							
		Voltag	e Input	range					
Mappi	ng to	Ch.0	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7
Chann	el	JP 0	JP 1	JP 2	JP 3	JP 4	JP 5	JP 6	JP 7



Picture 12: Selecting between thermocouple and mA measurement mode in ADAM-4018+

3 COMMISSIONING ADAM MODULE TO AQ2XX

3.1 AQ-2XX VERSION INFORMATION

Following versions are required in AQ-2xx relays to have this latest functionality with ADAM-4015 and ADAM-4018+ modules.

AQ-21x

F/V/S/P/E models: FVSPE_1.0.11-384 or newer

T model: T_1.0.11-313 or newer

G model: G_1.0.11-342 or newer

M model: M_1.0.11-370 or newer

AQ-25x

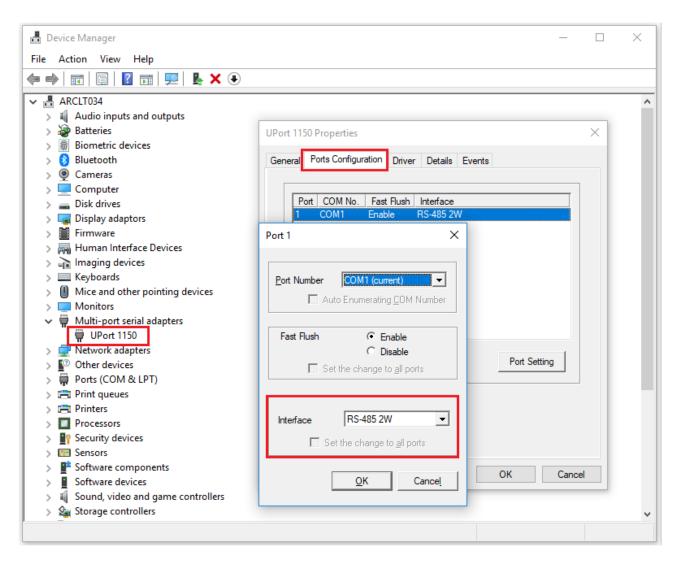
All models: v.2.5.6.1-1 or newer

3.2 FACTORY DEFAULT ADAM UNIT

First thing needed is RS485 to USB converter which can be used to configure ADAM unit. If ADAM unit is with Advantech factory settings then communication protocol and ModBus address must be set for the ADAM before it can be connected to AQ-2xx RS485 port. Arcteq uses Moxa Uport 1150 RS-232/422/485 USB-to-Serial converter. This can be purchased from Arcteq with code: SP-ADAM-KIT.

🛃 Device Manager	_	
File Action View Help		
(+ +) ■ 🖾 ■ 🖳 💺 🗙 💿		
 ARCLT034 Audio inputs and outputs Batteries Biometric devices Bluetooth Cameras Computer Disk drives Display adaptors Firmware Muman Interface Devices Firmware Imaging devices Keyboards Mice and other pointing devices Monitors Multi-port serial adapters Network adapters Vetwork adapters Vetwork adapters MOXA USB Serial Port (COM1) Firnt queues 	MOXA USB Serial Port (COM1) Properties General Port Settings Driver Details Events Baud Rate: 9600 V Data bits: 8 Party: None Stop bits: 1 V Flow control: None	
> 🚍 Printers > 🔲 Processors		
> Security devices		
> En Sensors		
Software components	OK Cance	
> Software devices	Cance	
> 🖣 Sound, video and game controllers		
> 🍇 Storage controllers		~
-		

Picture 13: Settings for Moxa USB-to-Serial converter, general.



Picture 14: Settings for Moxa USB-to-Serial converter, Interface.

File	Tools Setup Help				
🖰 🔙	Search Device				
	Add Devices to Group Group Configuration	Setting			1
	Terminal for Command Testing Print Screen	Port:	COM1		
	Html Files Packager Monitor Stream/Event Data	Baudrate:	9600 💌		
<u>⊡</u>	Monitor Peer to Peer	Parity:	None		
	Monitor GCL IO Data Message Monitor APAX	Databits:	8		
	WISE MQTT	Stopbits:	1 •		
		Flow Control:	None		
		Timeout:	1000 • ms	Default	
		Scan interval:	1000 • ms	Apply	

🔀 Advantech Adam/Apax .NET Utility (Win32) Version 2.05.11 (B19)

Picture 15: Open ADAM/Apax.NET Utility and Search devices.

Search module from COM1					
Starting address:	0		Start		
Scanning address:	00	(HEX)	Cancel		
	0	(DEC)			

Picture 16: Start searching from address 0.

Advantech Adam/Apax .NET Utility (Win32)	/ersion 2.05.11 (B19)		
File Tools Setup Help			
	ADAM-4015 Module setting Data area	1	
0.2.5.31 Others	Address:	101 Hex 1 - Dec	Apply change
- 🛃 Favorte Group 🗈 🔁 ADAM4500_5510Series	Baudrate:	9600 bps	
E 🤞 Wreless Sensor Networks	Checksum:	□ Enabled	Save/Load Configuration
	Firmware version:	A2.08 B00	Save
	Data format:	Engineering Unit	Load
	Comm. WDT:	0 Sec (0.0~999.9)	
	Protocol:	Modbus	
	Integration time:	60Hz 💌	

Picture 17: ADAM unit should appear under COMx and with clicking the ADAM unit it's automatically connected to your PC. Address should be unique for all ADAM units in same RS485 loop. Data format should be: "Engineering Unit" and Protocol: "Modbus". These settings are visible only when INIT*-pin is connected to the ADAM GND-pin and unit is powered up with this connection done.

After changing the settings "Apply change" must be pressed and after writing to ADAM is completed the ADAM unit must be rebooted (power off/ power on) to validate the changed parameters. **Only after rebooting the ADAM unit the changes take effect.**

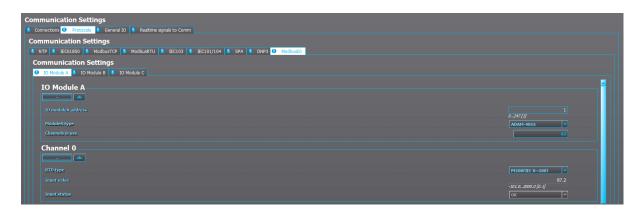
3.3 PRE-CONFIGURED ADAM UNIT

If you have purchased ADAM-4015 or ADAM-4018+ from Arcteq directly then you can skip point 3.1 as units sold by Arcteq have pre-configuration inside the unit. Therefore, no need to set the address and protocol for ADAM-unit as they are already set. Address of the unit can be found from the sticker attached to the side of the ADAM.

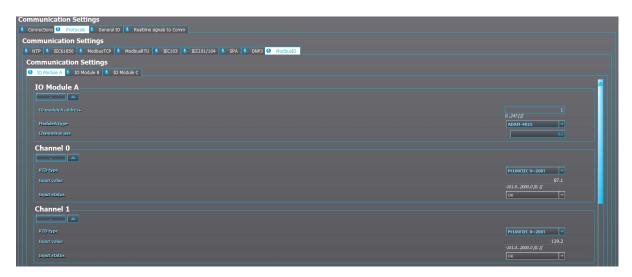
3.4 Setting up RS485 communication for ADAM in the AQ2xx $\,$

Communication Settings Connections Fortocols General 10 Realtime signals to Comm	
Ethernet	
IP address	
Serial COM1	
Bitrate	9600bos 💌
Parity	None
Stophits	
Protocol	I2[i] NodbusI0
Serial COM2	
Serial COM3	

Picture 18: Set Serial COM1 to 9600bps, 8N1, ModbusIO



Picture 19: Set IO module A address to the same as set to the ADAM unit connected. Then set correct ADAM-module type: ADAM-4015 or ADAM-4018+. 3.5 SETTING PROTECTION FUNCTION ACCORDING TO TEMPERATURE



Picture 20: Set channels 0-5 according to the type of RTD sensor connected to the ADAM-4015. AQ-2xx writes this RTD sensor type directly to the ADAM-4015 with Modbus.

Protec	tion Settings	
🛛 Stage	activation 📴 GeneratorModule 🔮 Current 🎼 Voltage 😑 Frequency 🔛 Sequence 🔛 Supporting	
Prote	ction Settings	
GS1	AT 🕗 RTD 🐌 Running hour counter	
Prot	ection Settings	
0 1	RO D D EVENTS	
	TD Settings	<
	RTD Sensor 1 settings	
	SLenable	Yes
	ST Module	ExtModuleA 🔻
	51 Channel	Ch0 👻
	SL Deg C / Deg F	Dea C
		87.1 deg -200.02000.0 [0.1]
	SI Pleasurement filter (low pass)	
		0.002000.00 [0.01]
	51 Sensor	0k 🔻
	S1 Enable Alarm1	Enable
	51 Alarn1.> / <	> ▼
		120 deg
	S1 Enable Alarm2	Enable
	51 Alarm2 > / <	>
		-200.02000.0 [0.1]

Picture 21: Set RTD protection module according to your application. Note: S1 module: ExtModuleA (B,C)

Modbus Map				?
Configure				
olding Register	Parameter	Access	Length	Info
1562				HR1561 (Lo-16bits)
1563	RTDIN:S16 Measurement mA			FLOAT [0.00020.000] (Hi-16bits)
R1564				HR1563 (Lo-16bits)
R1565	RTD1:S1 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1566				HR1565 (Lo-16bits)
R1567	RTD1:S2 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1568				HR1567 (Lo-16bits)
R1569	RTD1:S3 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1570				HR1569 (Lo-16bits)
R1571	RTD1:S4 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1572				HR1571 (Lo-16bits)
R1573	RTD1:S5 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1574				HR1573 (Lo-16bits)
R1575	RTD1:S6 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1576				HR1575 (Lo-16bits)
R1577	RTD1:S7 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1578				HR1577 (Lo-16bits)
R1579	RTD1:S8 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1580				HR1579 (Lo-16bits)
R1581	RTD1:S9 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1582				HR1581 (Lo-16bits)
R1583	RTD1:S10 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
IR1584				HR1583 (Lo-16bits)
IR1585	RTD1:S11 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1586				HR1585 (Lo-16bits)
R1587	RTD1:S12 Measurement (Protection)			FLOAT [-200.02000.0] (Hi-16bits)
R1588				HR1587 (Lo-16bits)
R1589	RTD1:S1 ALARM1 ON	RW		SIGNAL_OUT [04294967295] (Hi.
R1590				HR1589 (Lo-16bits)

Picture 22: Reading measurements to Modbus TCP. RTD1:S1 Measurement (Protection) is the correct register for picture 21 configuration.

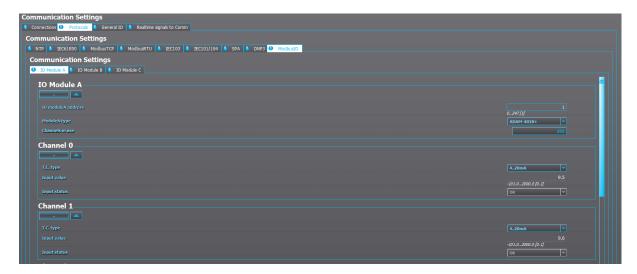
odbusTCP ModbusRTU SPA	IEC 104	IEC 101	IEC61850	DNP3TCP	DNP3RTU						
					Connection						
Connect Disconnect IP: 10.2.5.134				Port: 502				Status: ConnectedSta			
				FOIL: 302				Status: Corriectedsta			
Read (every 1s)						Read respons	se				
	Transa	ction ID: 78			Error:	Code: No error			Type: float32	🔽 🗌 Save	to file Open file location
art address: 1565		Address	Value (unit16)	Value (chosen)							
	_			value (chosen,							
antity: 2	<u> </u>	HR1565	17070	87.190							
	2	HR1566	24910								
Single read Request Stop	3										
	4										
Write	5										
	6										
dress: 1-65535	7										
	8										
lue: 0000-ffff hex16	- 9										
	10										
Request											
Control											
						Event log					
<select></select>	_ _{0 61}	able									
_	Time		Event C	odo.							Sequence Inde
Open											
			10.580 SYSTEM I 5:56.055 DIAGNOS								2268 2267
Close			26.081 DIAGNOS								2267
			2:56.058 DIAGNOS								2265
Time Sync		1000101333 00.4	DIAGNO	stree contrigutatio	in chongeor cical						
TimeSync Synced at 18:56:00 11.01.2	.019										

Picture 23: Modbus holding register 1565 read with AQWire protocol tester.

1 Modbus Map				?
Configure				
lolding Register	Parameter	Access	Length	Info
R1663	MBIO:MBIO ModA Ch1 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1664				HR1663 (Lo-16bits)
IR1665	MBIO:MBIO ModA Ch2 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1666				HR1665 (Lo-16bits)
IR1667	MBIO:MBIO ModA Ch3 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1668				HR1667 (Lo-16bits)
R1669	MBIO:MBIO ModA Ch4 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1670				HR1669 (Lo-16bits)
IR1671	MBIO:MBIO ModA Ch5 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1672				HR1671 (Lo-16bits)
IR1673	MBIO:MBIO ModA Ch6 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
R1674				HR1673 (Lo-16bits)
R1675	MBIO:MBIO ModA Ch7 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
R1676				HR1675 (Lo-16bits)
IR1677	MBIO:MBIO ModA Ch8 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1678				HR1677 (Lo-16bits)
IR1679	MBIO:MBIO ModB Ch1 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
IR1680				HR1679 (Lo-16bits)
IR1681	MBIO:MBIO ModB Ch2 Invalid	RW		SIGNAL_OUT [04294967295] (Hi-16bits)
		Cla		

Picture 24: Measurement valid/invalid data can be found from these Modbus holding registers.

3.6 Setting on load tap changer function according to MA signal



Picture 25: Set channels 0-7 according to the sensor (or mA measurement) connected to the ADAM-4018+. AQ-2xx writes this sensor type directly to the ADAM-4018+ with Modbus.

ontrol Settings	
Controls Enabled 🖹 Setting Groups 🖉 Objects 🚰 Control Functions 🖤 Device IO	
Control	
Voltage regulator	
Control Settings	
O INFO SETTINGS REGISTERS D IO EVENTS	
Tap Settings	
Tap position indication	mA External input
External mA input channel	CHO
Tap position ind. Setting	Set Ok V
Tap steps totally	
Tap center position	9 page 135 [1]
Tap step effect	L.35 [J] 1.67 %
	0.0110.00 [0.01]
	200.4 Vpri 0.0005000.000 [0.010]
Tap maximum decrease	-15.03 % <i>Un</i>
Tap maximum increase	-140.000.0.000 [0.010] 15.03 %un
	0.000140.000 [0.010]
	30.06 %U/r 0.000140.000 [0.010]
Tap position indication	Max.mA.max.Pos.
	4 mA
mA input high range	0.00020.000 [0.001]
	0.01020.000 [0.001]
	0.889 m4 0.00020.000 (0.001)
	12.206 m4
mA input now(in the set range)	0.00020.000 [0.001] 8.206 m4
	0.00020.000 [0.001]

Picture 26: Set Tap position indication to "mA External input". Set "External mA input" channel to the channel where mA input is connected.

4 REFERENCE INFORMATION

Manufacturer information:

Arcteq Ltd. Finland

Visiting and postal address:

Wolffintie 36 F 12 65200 Vaasa, Finland

Contacts:

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