



ModBus Interface Description

xBALL 4.0

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General notes

General information

Date	30.06.26
Product Name	xBALL 4.0
Product Model Number	X80..M...A4
Protocol	ModBus RTU over RS-485

Power-on behaviour

The initialization of the data after power fail takes up to 10 seconds.
All values remain 0 during power-on.

ModBus RTU

Transmission Formats	1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1, 1-8-E-2, 1-8-O-2 (Default: 1-8-N-2)
Baud Rates	1'200, 2'400, 4'800, 9'600, 19'200, 38'400 Bd (Default: 19'200)
Address	1...247 (Default: 19)
Number of Nodes	Max. 32 (without repeater)
Terminating Resistor	120 Ω

Configuration

Tool	xBALL Syncra
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Register implementation

All data is arranged in a table and addressed by 1..n (Register No.) or 0..n-1 (Address).

Supported commands

Standard commands:	
Read Coils [1]	Write Single Coil [5]
Read Discrete Inputs [2]	Write Single Register [6]
Read Holding Registers [3]	Write Multiple Coils [15]
Read Input Registers [4]	Write Multiple Registers [16]

Interpret values in the registers

All values in the register are signed integer data types.
Exceptions are marked with **. Signed integers are represented as two's complement.

Example unsigned integer:	Example signed integer:
Read (Function 03, 1 Register)	Read (Function 03, 1 Register)
Value Register No. x	Value Register No. x
= 0001 1010 1100 1000 ₂	= 1111 1101 1111 0010 ₂
= 6,856 ₁₀	= -526 ₁₀
Actual value	Actual value
= value * scaling factor * unit	= value * scaling factor * unit
= 6,856 * 0.01 * unit	= -526 * 0.01 * unit
= 68.56 unit	= -5.26 unit

Register overview

No.	Address	Register	Access
R1	0	Absolute Valve Position [°]	R
R2	1	Percentage Valve Position [%]	R
R3	2	Feedback Signal	R
R4	3	Percentage Feedback Signal [%]	R
R5	4	Regulation State	R
R6	5	Evaporation Pressure Probe Measurement [barg]	R
R7	6	Evaporation Pressure Probe Measurement [psig]	R
R8	7	Suction Temperature Probe Measurement [°C]	R
R9	8	Suction Temperature Probe Measurement [°F]	R
R10	9	Evaporation Temperature [°C]	R
R11	10	Evaporation Temperature [°F]	R
R12	11	Superheat [K]	R
R13	12	Superheat [°F]	R
R101	100	Device PIN Info **)	R
R102	101	Serial Number Device Info **)	R
R103	102	Serial Number Device Info **)	R
R104	103	Field 1 Of The Gearbox **)	R
R105	104	Field 2 Of The Gearbox **)	R
R106	105	Field 3 Of The Gearbox **)	R
R107	106	Field 4 Of The Gearbox **)	R
R108	107	Hardware Release Info **)	R
R109	108	Firmware Release Info **)	R
R110	109	HMI Release Info **)	R
R111	110	Device Type Info **)	R
R112	111	Operating Days Info **)	R
R113	112	Operating Hours Info **)	R
R114	113	Number Of Completed Cycles (high part) Info **)	R
R115	114	Number Of Completed Cycles (low part) Info **)	R
R116	115	Supply Voltage Frequency [Hz] **)	R
R201	200	Manual Positioner Position	R / W
R202	201	Machine Cooling Capacity [%]	R / W
R203	202	Service 1 (self-resetting values)	R / W
R204	203	Service 2 (non-self-resetting bit-fields)	R / W
R205	204	PIN Entry Field **)	R / W

**) unsigned integer

No.	Address	Register	Access
R301	300	Measurement System	R / W
R302	301	Refrigerant	R / W
R303	302	Configuration Index Of T Probe preset	R / W
R304	303	..	..
R305	304	..	..
R306	305	Control mode	R / W
R307	306	..	..
R308	307	Regulation algorithm selection	R / W
R309	308	Percent Valve Opening at Start [%]	R / W
R310	309	Regulation Start Delay	R / W
R311	310	Standby Opening Percentage Position [%]	R / W
R312	311	Pressure Probe Type	R / W
R313	312	Pressure Probe Time Constant Of Digital Filter	R / W
R314	313	..	..
R315	314	Pressure Probe Failure Recovery Action	R / W
R316	315	Pressure Probe Failure Recovery Action Delay	R / W
R317	316	Temperature Probe Type	R / W
R318	317	Temperature Probe Time Constant Of Digital Filter	R / W
R319	318	Temperature Probe Failure Recovery Action	R / W
R320	319	Temperature Probe Failure Recovery Action Delay	R / W
R321	320	LED ring configuration	R / W
R322	321	Valve Model Optimisation	R / W
R323	322	Service	R / W
R324	323	..	..
R325	324	..	..
R326	325	RS-485 Network Address	R / W
R327	326	RS-485 Speed	R / W
R328	327	Parity	R / W
R329	328	Stop Bits	R / W
R330	329	Bus Communication Failure Recovery Action	R / W
R331	330	Bus Communication Failure Recovery Action Delay	R / W
R332	331	PID Proportional Gain	R / W
R333	332	PID Integral Time	R / W
R334	333	PID Derivative Time	R / W
R335	334	LSH (low superheating) Protection Integral Time	R / W
R336	335	LSH (low superheating) Protection Alarm Delay	R / W
R337	336	LSU (low suction temperature) Protection Alarm Delay	R / W
R338	337	LSU (low suction temperature) Protection Integral Time	R / W

Definition Access: R = Read, W = Write

No.	Address	Register	Access
R339	338	LOP (low evaporation temperature) Protection Alarm Delay [s]	R / W
R340	339	MOP (high evaporation temperature) Protection Alarm Delay [s] [10]	R / W
R341	340	MOP (high evaporation temperature) Protection Alarm Delay [s]	R / W
R401	400	Superheat Setpoint [K]	R / W
R402	401	Maximum Pressure Probe Valve [barg]	R / W
R403	402	Minimum Pressure Probe Valve [barg]	R / W
R404	403	Pressure Probe Calibration Offset [barg]	R / W
R405	404	Maximum Pressure Probe Alarm Value [barg]	R / W
R406	405	Minimum Pressure Probe Alarm Value [barg]	R / W
R407	406	Temperature Probe Calibration Offset [°C]	R / W
R408	407	Maximum Temperature Probe Alarm Value [°C]	R / W
R409	408	Minimum Temperature Probe Alarm Value [°C]	R / W
R410	409	LSH (low superheat) protection threshold [°C]	R / W
R411	410	LSU (low suction temperature) Protection Alarm Threshold [°C]	R / W
R412	411	LOP (low evaporation temperature) Protection Threshold [°C]	R / W
R413	412	MOP (high evaporation temperature) Protection Threshold [°C]	R / W
R414	413	MOP (high evaporation temperature) Protection Suction Threshold [°C]	R / W
R501	500	Superheat Setpoint [°F]	R / W
R502	501	Maximum Pressure Probe Value [psig]	R / W
R503	502	Minimum Pressure Probe Value [psig]	R / W
R504	503	Pressure Probe Calibration offset [psig]	R / W
R505	504	Maximum Pressure Probe Alarm Value [psig]	R / W
R506	505	Minimum Pressure Probe Alarm Value [psig]	R / W
R507	506	Temperature Probe Calibration Offset [°F]	R / W
R508	507	Maximum Temperature Probe Alarm Value [°F]	R / W
R509	508	Minimum Temperature Probe Alarm Value [°F]	R / W
R510	509	LSH (low superheat) Protection Threshold [°F]	R / W
R511	510	LSU (low suction temperature) Protection Alarm Threshold [°F]	R / W
R512	511	LOP (low evaporation temperature) Protection Threshold [°F]	R / W
R513	512	MOP (high evaporation temperature) Protection Evaporation Threshold [°F]	R / W
R514	513	MOP (high suction temperature) Protection Suction Threshold [°F]	R / W



All writeable registers >200 are persistent and are **not** supposed to be written on a regular basis. Designated registers are highlighted in colour in the document.

Coil descriptions

No.	Address	Coil	Access
C1	0	Hardware alarm	R
C2	1	Gearbox alarm	R
C3	2	Bus Communication Alarm	R
C4	3	Evaporation Pressure Probe Alarm	R
C5	4	Suction Temperature Probe Alarm	R
C6	5	LSH (low superheat) Alarm	R
C7	6	LSU (low suction temperature) Alarm	R
C8	7	LOP (low evaporation temperature) Alarm	R
C9	8	MOP (high evaporation temperature) Alarm	R
C10	9	LSH (low superheat) Protection Activation Notification	R
C11	10	LOP (low evaporation temperature) Protection Activation Notification	R
C12	11	MOP (high evaporation temperature) Protection Activation Notification	R
C13	12	Digital Input Activation Notification	R
C101	100	Regulation Enabling	R / W
C102	101	Evaporation Pressure Probe Alarm Enabling	R / W
C103	102	Suction Temperature Probe Alarm Enabling	R / W
C104	103	Start Adaption Procedure	R / W
C105	104	Manual Positioner Enabling	R / W
C106	105	Termination Resistor Enabling	R / W



All writeable coils >100 are persistent and are **not** supposed to be written on a regular basis. Designated registers are highlighted in colour in the document.

Register descriptions

Control and general settings

These registers can be used to control and configure the fundamental functionalities and read the corresponding feedback values of the device.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R1	0	Absolute valve position	0...10'000	points	1	R
R2	1	Percentage valve position	0...100	%	1	R
R3	2	Feedback signal	0...1'000	V	0.01	R
R4	3	Percentage feedback signal	0...100	%	1	R
R5	4	Regulation State	0: Disabled 10: Stop regulation 40: Closed valve 50: Stand-by 60: Moving 70: Moving 80: Moving 90: Wait 100: Regulation	–	–	R
R6	5	Evaporation pressure probe measurement	–200...2'000	barg	0.1	R
R7	6	Evaporation pressure probe measurement	–2'901...29'008	psig	0.1	R
R8	7	Suction temperature probe measurement	–850...2'000	°C	0.1	R
R9	8	Suction temperature probe measurement	–1'210...3'920	°F	0.1	R
R10	9	Evaporation temperature	–850...2'000	°C	0.1	R
R11	10	Evaporation temperature	–1'210...3'920	°F	0.1	R
R12	11	Superheat	–400...1'800	K	0.1	R
R13	12	Superheat	–400...3'560	°F	0.1	R

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R101	100	Device PIN info	0...65'535	–	–	R
R102	101	Serial number device info 4 most significant digits	0...9'999	–	–	R
R103	102	Serial number device info 4 less significant digits	0...9'999	–	–	R
R104	103	Field 1 of the gearbox S/N	0...65'535	–	–	R
R105	104	Field 2 of the gearbox S/N	0...65'535	–	–	R
R106	105	Field 3 of the gearbox S/N	0...65'535	–	–	R
R107	106	Field 4 of the gearbox S/N	0...65'535	–	–	R
R108	107	Hardware release info Format: 0xmmnnMM Ex: 3.8.2 = 0x020803	0...65'535	–	–	R
R109	108	Firmware release info Format: 0x0A0102 Ex: 2.1.10 = 0x0A0102	0...65'535	–	–	R
R110	109	HMI release info	0...0	–	–	R
R111	110	Device type info	0...4 0: xBALL replacement (Silab module) 2: xBALL replacement (EsplF module) 3: xBALL controller 4: xBALL controller big	–	–	R
R112	111	Operating days info	0...65'535	days	–	R
R113	112	Operating hours info	0...24 Default: 0	hours	–	R
R114	113	Number of completed cycles (high part) info	0...65'535	–	–	R
R115	114	Number of completed cycles (low part) info	0...65'535	–	–	R
R116	115	Supply voltage frequency	0...100	Hz	–	R
R201	200	Manual positioner position	0...10'000 Default: 0	points	–	R / W
R202	201	Machine cooling capacity	0...100 Default: 0	%	–	R / W
R203	202	Service 1 self-resetting values	0...65'535 Default: 0	–	–	R / W
R204	203	Service 2 non-self-resetting bit-fields	–32'768...32'768 Default: 0	–	–	R / W
R205	R206	PIN entry field	0...65'535 Default: 0	–	–	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R301	300	Measurement system	1: International system 2: British Imperial system Default: 1	–	–	R / W
R302	301	Refrigerant	1: R1233zd(e) 2: R1234yf 3: R1234ze 4: R1270 5: R134a 6: R290 7: R32 8: R404a 9: R407A 11: R410a 12: R449A 13: R449C 14: R452A 15: R452B 16: R454A 17: R454B 18: R454C 19: R463A 20: R507a 21: R513A 22: R514A 23: R515B 24: R600 25: R600a 26: R744 Default: 5	–	–	R / W
R303	302	Configuration index of P probe preset For app only	0...16 Default: 1	–	–	R / W
R304	303	..	..	..	..	..
R305	304	..	..	..	..	..
R306	305	Control mode	1: A/D mode 2: Bus mode Default: 2	–	–	R / W
R307	306	..	..	..	..	..
R308	307	Regulation algorithm selection	1: SH regulation	–	–	R / W
R309	308	Percent valve opening at start	0...100 Default: 50	%	–	R / W
R310	309	Regulation start delay	0...20'000 Default: 0	s	–	R / W
R311	310	Standby opening percentage position	0...100 Default: 0	%	–	R / W
R312	311	Pressure probe type	1: Electronic probe (4...20 mA) 2: Ratiometric probe (0/5 V) Default: 2	–	–	R / W
R313	312	Pressure probe time constant of digital filter	1...200 Default: 6	s	–	R / W
R314	313	..	..	..	..	..
R315	314	Pressure probe failure recovery action	1: No action 2: Forced closure 3: Fixed position Default: 1	–	–	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R316	315	Pressure probe failure recovery action delay	0...20'000 Default: 0	s	–	R / W
R317	316	Temperature probe type	1: NTC standard probe	–	–	R / W
R318	317	Temperature probe time constant of digital filter	1...120 Default: 6	s	–	R / W
R319	318	Temperature probe failure recovery action	1: No action 2: Forced closure 3: Fixed position Default: 1	–	–	R / W
R320	319	Temperature probe failure recovery action delay	0...20'000 Default: 0	s	–	R / W
R321	320	LED ring configuration «halo»	1: Always off 2: Moving direction 3: Opening percentage Default: 2	–	–	R / W
R322	321	Valve model optimisation	0: Generic 10: EX*10 20: EX*20 50: EX*50 75: EX*75 100: EX*100 200: EX*200 Default: 0	–	–	R / W
R323	322	Service	0...10'000 Default: 0	–	–	R / W
R324	323	..	..	..	..	..
R325	324	..	..	..	..	..
R326	325	RS-485 network address	1...255 Default: 19	–	–	R / W
R327	326	RS-485 speed Baud rate in bits per second	1: 1'200 2: 2'400 3: 4'800 4: 9'600 5: 19'200 6: 38'400 Default: 5	–	–	R / W
R328	327	Parity	1: None 2: Even 3: Odd Default: 1	–	–	R / W
R329	328	Stop bits	1: 1 stop bit 2: 2 stop bits 1...2 Default: 2	–	–	R / W
R330	329	Bus communication failure recovery action	1: No action 2: Regulation stop and disable manual posit Default: 1	–	–	R / W
R331	330	Bus communication failure recovery action delay	0...20'000 Default: 5	s	–	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R332	331	PID proportional gain	0...10'000 Default: 500	points	1	R / W
R333	332	PID integral time	0...20'000 Default: 400	s	0.1	R / W
R334	333	PID derivative time	0...20'000 Default: 10	s	0.1	R / W
R335	334	LSH (low superheating) protection integral time	0...20'000 Default: 30	s	0.1	R / W
R336	335	LSH (low superheating) protection alarm delay	0...20'000 Default: 300	s	1	R / W
R337	336	LSU (low suction temperature) protection alarm delay	0...20'000 Default: 300	s	1	R / W
R338	337	LSU (low suction temperature) protection integral time	0...20'000 Default: 40	s	0.1	R / W
R339	338	LOP (low evaporation temperature) protection alarm delay	0...20'000 Default: 300	s	1	R / W
R340	339	MOP (high evaporation temperature) protection integral time	0...20'000 Default: 100	s	0.1	R / W
R341	340	MOP (high evaporation temperature) protection alarm delay	0...20'000 Default: 600	s	1	R / W
R401	400	Superheat setpoint	-400...1'800 Default: 60	K	0.1	R / W
R402	401	Maximum pressure probe valve	-200...2'000 Default: 93	barg	0.1	R / W
R403	402	Minimum pressure probe valve	-200...2'000 Default: -10	barg	0.1	R / W
R404	403	Pressure probe calibration offset	-200...2'000 Default: 0	barg	0.1	R / W
R405	404	Maximum pressure probe alarm value	-200...2'000 Default: 93	barg	0.1	R / W
R406	405	Minimum pressure probe alarm value	-200...2'000 Default: -10	barg	0.1	R / W
R407	406	Temperature probe calibration offset	-200...200 Default: 0	°C	0.1	R / W
R408	407	Maximum temperature probe alarm value	-850...2'000 Default: 1'050	°C	0.1	R / W
R409	408	Minimum temperature probe alarm value	-850...2'000 Default: -500	°C	0.1	R / W
R410	409	LSH (low superheat) protection threshold	-850...2'000 Default: 20	°C	0.1	R / W
R411	410	LSU (low suction temperature) protection alarm threshold	-850...2'000 Default: -500	°C	0.1	R / W
R412	411	LOP (low evaporation temperature) protection threshold	-850...2'000 Default: -500	°C	0.1	R / W
R413	412	MOP (high evaporation temperature) protection threshold	-850...2'000 Default: 500	°C	0.1	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
R414	413	MOP (high evaporation temperature) protection suction threshold	-850...2'000 Default: 300	°C	0.1	R / W
R501	500	Superheat setpoint	-400...3'560 Default: 428	°F	0.1	R / W
R502	501	Maximum pressure probe value	2'901...29'008 Default: 1'349	psig	0.1	R / W
R503	502	Minimum pressure probe value	-2'901...29'008 Default: -145	psig	0.1	R / W
R504	503	Pressure probe calibration offset	2'901...29'008 Default: 0	psig	0.1	R / W
R505	504	Maximum pressure probe alarm value	2'901...29'008 Default: 1'349	psig	0.1	R / W
R506	505	Minimum pressure probe alarm value	2'901...29'008 Default: -145	psig	0.1	R / W
R507	506	Temperature probe calibration offset	-360...360 Default: 0	°F	0.1	R / W
R508	507	Maximum temperature probe alarm value	-1'210...3'920 Default: 2'210	°F	0.1	R / W
R509	508	Minimum temperature probe alarm value	-1'210...3'920 Default: -580	°F	0.1	R / W
R510	509	LSH (low superheat) protection threshold	-1'210...3'920 Default: 356	°F	0.1	R / W
R511	510	LSU (low suction temperature) protection alarm threshold	-1'210...3'920 Default: -580	°F	0.1	R / W
R512	511	LOP (low evaporation temperature) protection threshold	-1'210...3'920 Default: -580	°F	0.1	R / W
R513	512	MOP (high evaporation temperature) protection evaporation threshold	-1'210...3'920 Default: 1'220	°F	0.1	R / W
R514	513	MOP (high suction temperature) protection suction threshold	-1'210...3'920 Default: 860	°F	0.1	R / W

Coil descriptions

Control and general settings

These coils can be used to control and configure the fundamental functionalities and read the corresponding feedback values of the device.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
C1	0	Hardware alarm	0...1	–	–	R
C2	1	Gearbox alarm	0...1	–	–	R
C3	2	Bus communication alarm	0...1	–	–	R
C4	3	Evaporation pressure probe alarm	0...1	–	–	R
C5	4	Suction temperature probe alarm	0...1	–	–	R
C6	5	LSH (low superheat) alarm	0...1	–	–	R
C7	6	LSU (low suction temperature) alarm	0...1	–	–	R
C8	7	LOP (low evaporation temperature) alarm	0...1	–	–	R
C9	8	MOP (high evaporation temperature) alarm	0...1	–	–	R
C10	9	LSH (low superheat) protection activation notification	0...1	–	–	R
C11	10	LOP (low evaporation temperature) protection activation notification	0...1	–	–	R
C12	11	MOP (high evaporation temperature) protection activation notification	0...1	–	–	R
C13	12	Digital input activation notification	0...1	–	–	R
C101	100	Regulation enabling	0...1 Default: 0	–	–	R / W
C102	101	Evaporation pressure probe alarm enabling	0...1 Default: 1	–	–	R / W
C103	102	Suction temperature probe alarm enabling	0...1 Default: 1	–	–	R / W
C104	103	Start adaption procedure	0...1 Default: 0	–	–	R / W
C105	104	Manual positioner enabling	0...1 Default: 0	–	–	R / W
C106	105	Termination resistor enabling	0...1 Default: 0	–	–	R / W

All inclusive

Belimo is the global market leader in the development, production, and sales of field devices for the energy-efficient control of heating, ventilation and air-conditioning systems. The focus of our core Business is on damper actuators, control valves, sensors and meters.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.



5-year warranty



On site around the globe



Complete product range



Tested quality



Short delivery times



Comprehensive support



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