

EWIO₂ BACnet Server

BACnet プロトコル実装適合性宣言

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ベンダー名	METZ CONNECT GmbH
製品名	BACnet Server for EWIO ₂ , following variants
製品モデル番号	110934, EWIO ₂ -MW-BM 110935, EWIO ₂ -M-BM 110909, EWIO ₂ -W-BM 110904, EWIO ₂ -BM

:アプリケーション・ソフトウェアのバージョン2.0

ファームウェアの改訂	0.8.5-MC
BACnetプロトコルの改訂	16

商品説明

EWIO₂用BACnet/IPサーバー： アプリケーション専用コントローラー

- 8デジタル入力
- 6リレー出力、2トライアック出力
- 4リレー出力、1Mバスマスターインターフェース
- 4トランジスタ出力 (pnp)、
- 3アナログ出力 (0-10 V)、
- アナログ入力3系統 (0-10 V、Ohm、0-20 mA)、
- 2つのModbusインターフェース

(EWIO₂-W-BM, EWIO₂-BM),
(EWIO₂-MW-BM, EWIO₂-M-BM)

これらの拡張モジュールが利用できます。

- digital: MR-DI4, MR-SI4, MR-DI10, MR-DO4, MR-TO4, MR-DIO4/2,
- analog: MR-AI8, MR-CI4, MR-AO4 and MR-AOP4.

BACnet 標準デバイス・プロファイル (Annex L) :

BACnetアプリケーション専用コントローラ (B-ASC)

サポートされるすべてのBACnet相互運用性ビルディング・ブロックのリスト (附属書K) :

Data Sharing-ReadProperty-B	(DS-RP-B)
Data Sharing-WriteProperty-B	(DS-WP-B)
Data Sharing-ReadPropertyMultiple-B	(DS-RPM-B)
Data Sharing-WritePropertyMultiple-B	(DS-WPM-B)
Data Sharing-COV-B	(DS-COV-B)
Device Management-Dynamic Device Binding-B	(DM-DDB-B)
Device Management-Dynamic Object Binding-B	(DM-DOB-B)
Device Management-DeviceCommunicationControl-B	(DM-DCC-B, no Password)
Device Management-ReinitializeDevice-B	(DM-RD-B, no Password)
Device Management-Backup and Restore-B	(DM-BR-B, no Password)
Device Management-TimeSynchronization-B	(DM-TS-B)
Device Management-UTCTimeSynchronization-B	(DM-UTC-B)
Device Management-Object Creation and Deletion-B	(DM-OCD-B)
Network Management-BBMD Configuration-B	(NM-BBMD-B)
Network Management-Foreign Device Registration-A	(NM-FDR-A)
Gateway-Embedded Objects-B	(GW-EO-B, extension modules)
Trending-Viewing and Modifying Trends Internal-B	(T-VMT-I-B)

サポートされる標準オブジェクトタイプ：

サポートされる標準オブジェクト・タイプ： オブジェクト・タイプは、それがデバイスに存在する可能性があれば、サポートされます。サポートされる各標準オブジェクトタイプについて、以下のデータを提供してください：

- 1) この型のオブジェクトが、**CreateObject** サービスを使用して動的に作成可能かどうか
- 2) この型のオブジェクトが、**DeleteObject** サービスを使用して動的に削除可能かどうか
- 3) サポートされるオプションプロパティのリスト
- 4) 書き込み可能なすべてのプロパティのリスト
- 5) 条件付きで書き込み可能なすべてのプロパティのリスト： なし
- 6) プロプライエタリ・プロパティのリストと、各プロパティの識別子、データ型、意味： なし
- 7) プロパティ範囲の制限のリスト

セグメンテーション能力：

- ☐ セグメント化されたメッセージを送信できる
☐ セグメント化されたメッセージを受信可能

Window Size _____

Window Size _____

データリンク層のオプション：

- ☒ BACnet IP, (Annex J)
☒ BACnet IP, (Annex J), Foreign Device

Device Address Binding:

静的デバイスバインディングに対応しているか? (これは現在、MS/TPスレーブや他の特定のデバイスとの双方向通信に必要です。) ☐ Yes ☒ No

ネットワークオプション：

- ☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
☐ Annex H, BACnet Tunneling Router over IP
☒ BACnet/IP Broadcast Management Device (BBMD)
 BBMDはForeign Devices” の登録に対応していますか? ☒ Yes ☐ No
 BBMDはネットワークアドレス変換をサポートしていますか? ☐ Yes ☒ No

Network Security Options:

- ☒ Non-secure Device - is capable of operating without BACnet Network Security
☐ Secure Device - is capable of using BACnet Network Security (NS-SD BIBB)
☐ Multiple Application-Specific Keys:
☐ Supports encryption (NS-ED BIBB)
☐ Key Server (NS-KS BIBB)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

- ☒ ISO 10646 (UTF-8) ☐ IBM™/Microsoft™ DBCS ☐ ISO 8859-1
☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS X 0208

デフォルトの文字列は、空の文字列を書き込むことで復元できます。

この製品が通信ゲートウェイの場合、ゲートウェイがサポートする非BACnet機器/ネットワークのタイプを記述します：

1.1 デバイスオブジェクト

プロパティ	Remark / Value	Conf.
Object_Type	DEVICE (8)	R
Object_Identifier	device, default instance: 421000	RW-N
Object_Name	max. 64 Bytes, default "EWIO2_BACnet"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Location	max. 64 Bytes, default ""	OW-N
Vendor_Name	"METZ CONNECT GmbH"	R
Vendor_Identifier	421	R
Model_Name	max. 64 Bytes, default "EWIO2 with BACnet Server"	RW-N
Firmware_Revision	"0.8.5-MC"	R
Application_Software_Version	"2.0"	R
Protocol_Version	1	R
Protocol_Revision	16	R
System_Status	OPERATIONAL (0, default), OPERATIONAL_READ_ONLY (1), NON_OPERATIONAL (4)	RW-V
Protocol_Services_Supported	read-property, read-property-multiple, write-property, write-property-multiple, subscribe-cov, who-has, who-is, device-communication-control, reinitialize-device, time-synchronisation, utc-time-synchronisation, atomic-read-file, atomic-write-file, read-range, create-object, delete-object	R
Protocol_Object_Types_Supported	DEVICE, ANALOG_INPUT, ANALOG_OUTPUT, ANALOG_VALUE, BINARY_INPUT, BINARY_OUTPUT, BINARY_VALUE, MULTI_STATE_VALUE, FILE, TREND_LOG, POSITIVE_INTEGER_VALUE	R
Object_List	device, analog-input 0...159, analog-output 0...159, analog-value 0...600, binary-input 0...159, binary-output 0...159, binary-value 0...1, multistate-value 0...159, file 0...5, trend-log 0...400, positive-integer-value 0...23. オブジェクトの存在は、デバイスのタイプ、拡張モジュールの使用、およびトレンドロギングに依存します。	R
Structured_Object_List		O
Max_APDU_Length_Accepted	1476	R
Segmentation_Supported	NO_SEGMENTATION (3)	R
APDU_Timeout	default 3000 ms	RW-N
Number_Of_APDU_Retries	default 3	RW-N
Device_Address_Binding	-	R
Database_Revision	Revision of Configuration File	R-N

Active_COV_Subscriptions	max. 30 Subscriptions, Confirmed / Unconfirmed, for binary-input, binary-output, analog-input, analog- output	O
Local_Time		O
Local_Date		O
UTC_Offset		O
Daylight_Savings_Status		O
Configuration_Files	file 0...5	O
Last_Restore_Time		O-N
Backup_Failure_Timeout	default 10 sec	OW-N
Backup_And_Restore_State		O
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

2 デジタル出力

2.1 バイナリ出力オブジェクト 0...13

プロパティ	Remark / Value	Conf.
Object_Type	BINARY_OUTPUT (4)	R
Object_Identifier	binary-output, instance 0 ... 13	R
Object_Name	max. 64 Bytes, default "Relay K1", "Triac T1", "Transistor Output D1" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Device_Type	max. 64 Bytes, default ""	OW-N
Inactive_Text	max. 32 Bytes, default "off"	OW-N
Active_Text	max. 32 Bytes, default "on"	OW-N
-	creatable / deletable	-
Present_Value	NULL (write only) / INACTIVE (0) / ACTIVE (1)	RP-V
Reliability	NO_FAULT_DETECTED (0) SHORTED_LOOP (5) = トランジスタ出力の短絡 UNRELIABLE_OTHER (7) = ハードウェアドライバ障害 COMMUNICATION_FAILURE (12) = 拡張モジュールなし	O
Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 / 1 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) TRUEなら、Present_ValueとReliabilityは書き込み可能で、処理されず、IOから切り離されます。	RW-N
Polarity	NORMAL (0) / REVERSE (1)	RW-N
Feedback_Value	INACTIVE (0) / ACTIVE (1)	O
Interface_Value	INACTIVE (0) / ACTIVE (1)	O
Priority_Array [16]	NULL / INACTIVE (0) / ACTIVE (1)	R
Relinquish_Default	INACTIVE (0) / ACTIVE (1)	RW-N
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

4つのリレーとMバスを備えたデバイスタイプ:

Instance 0: リレー K1, ターミナル 11, 12 (NC), 14 (NO)

Instance 1: リレー K2, ターミナル 21, 22 (NC), 24 (NO)

Instance 2: リレー K3, ターミナル 31, 32 (NC), 34 (NO)

Instance 3: リレー K4, ターミナル 41, 42 (NC), 44 (NO)

6個のリレーと2個のトライアックを備えたデバイスタイプ:

Instance 0: リレー K1, ターミナル 11, 12 (NC), 14 (NO)

Instance 1: リレー K2, ターミナル 21, 22 (NC), 24 (NO)

Instance 2: リレー K3, ターミナル 31, 32 (NC), 34 (NO)

Instance 3: トライアック T1, ターミナル T13, T14

Instance 4: トライアック T2, ターミナル T23, T24

Instance 5: リレー K4, ターミナル 41, 42 (NC), 44 (NO)

Instance 6: リレー K5, ターミナル 51, 52 (NC), 54 (NO)

Instance 7: リレー K6, ターミナル 61, 62 (NC), 64 (NO)

両デバイスタイプ:

Instance 10: トランジスタ出力 D1, ターミナル D1

Instance 11: トランジスタ出力 D2, ターミナル D2

Instance 12: トランジスタ出力 D3, ターミナル D3

Instance 13: トランジスタ出力 D4, ターミナル D4

PNP トランジスタスイッチ→24V, 20 mA max, 短絡防止

出力が他のアプリケーションによって制御されている場合、bacnet-serverはその出力を制御してはなりません。従ってオブジェクトを削除するかサービス停止にすることができます。Out-of-Service に切り替えた場合、Feedback_Value と Interface-Value プロパティには実際の出力値が表示されます。

バイナリ出力の機能テーブル							
Out_Of_Service	極性	スイッチ	Priority_Array	Present_Value	Binary Output	OVER RIDDEN	OUT_OF_SERVICE
0	0	Auto	0 / 1	0 / 1	0 / 1	0	0
0	1	Auto	0 / 1	0 / 1	1 / 0	0	0
1	0	Auto	0 / 1	0 / 1	x	0	1
1	1	Auto	0 / 1	0 / 1	x	0	1
Using hand off/on switches							
0	0	Hand 0 Hand 1	0 / 1 0 / 1	0 1	0 1	1	0
0	1	Hand 0 Hand 1	0 / 1 0 / 1	1 0	0 1	1	0
1	0	Hand 0 Hand 1	0 / 1 0 / 1	0 / 1 0 / 1	0 1	0	1
1	1	Hand 0 Hand 1	0 / 1 0 / 1	0 / 1 0 / 1	0 1	0	1

Auto / Hand keys:

長く押すとオートモードとハンドモードが切り替わり、緑色のLEDで表示されます。短時間の操作で出力のオン／オフが切り替わり、黄色のLEDで表示されます。

3 デジタル入力

3.1 Binary Input Object 0...7

Instance 0...3: Terminals 1+ / 1- ... 4+ / 4-, スイッチ接続用入力
Instance 4...7: Terminals 5+ / 5- ... 8+ / 8-, 光カップラ入力電圧24 V

プロパティ	Remark / Value	Conf.
Object_Type	BINARY_INPUT (3)	R
Object_Identifier	binary-input, instance 0 ... 7	R
Object_Name	max. 64 Bytes, default "Binary Input DI1" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Device_Type	max. 64 Bytes, default ""	OW-N
Inactive_Text	max. 32 Bytes, default "off"	OW-N
Active_Text	max. 32 Bytes, default "on"	OW-N
-	creatable / deletable	-
Present_Value	INACTIVE (0) / ACTIVE (1)	R
Reliability	NO_FAULT_DETECTED (0) UNRELIABLE_OTHER (7) = ハードワイヤ操作不良 COMMUNICATION_FAILURE (12) = 拡張モジュール無し	O
Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability 書き込み 可能で、処理されず、IOから切り離されます。	RW-N
Polarity	NORMAL (0) / REVERSE (1)	RW-N
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

バイナリ入力の機能表

Out_Of_Service	プロパティ	バイナリ入力	Present_Value	OUT_OF_SERVICE
0	0	0 1	0 1	0
0	1	0 1	1 0	0

1	0	0 1	x	1
1	1	0 1	x	1

x: Present_Valueは書き込み可能で、入力の影響を受けません。

3.2 Positive Integer Value Object 0...7

プロパティ	Remark / Value	Conf.
Object_Type	POSITIVE_INTEGER_VALUE (48)	R
Object_Identifier	positive-integer-value, instance 0 ... 7	R
Object_Name	max. 64 Bytes, default "Debounce Time DI1" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	Debounce Time of Binary Input 0...7, default 8	RW-N
Units	milliseconds (159)	R
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value は書き込み可能であり、処理されません。	RW-N
Min_Pres_Value	0	R
Max_Pres_Value	255	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

デバウンス時間は、デジタル入力のリレーやスイッチなどの接点で制御される場合に必要です。多くの場合、20～50msの時間が推奨されます。

この時間は入力信号を遅延させ、その周波数範囲を制限します。

入力が他のアプリケーションによって制御されている場合、bacnet-serverはその入力を制御してはなりません。このため、オブジェクトを削除したり、サービスを停止したりすることができます。

4 アナログ出力

4.1 Analog Output Object 0...2

Instance 0...2: Terminals O1 ... O3, 0-10 V

Property	Remark / Value	Conf.
Object_Type	ANALOG_OUTPUT (1)	R
Object_Identifier	analog-output, instance 0 ... 2	R
Object_Name	max. 64 Bytes, default "Voltage Output O1"...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Device_Type	max. 64 Bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	0.0 ... 102.4 (0 V ... 10.24 V) NULL (write only)	RP-V
Reliability	NO_FAULT_DETECTED (0) SHORTED_LOOP (5) = EWIO 出力の短絡 UNRELIABLE_OTHER (7) = ハードウェア機能不良 COMMUNICATION_FAILURE (12) = 拡張モジュール無し	O
Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 / 1 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability are書き込み可能 で、処理されず、IOから切り離されます。	RW-N
Units	percent (98)	R
Interface_Value	0.0 ... 102.4 (0 V ... 10.24 V)	O
Priority_Array [16]	NULL / 0.0 ... 102.4	R
Relinquish_Default	0.0 ... 102.4, default 0.0	RW-N
COV_Increment	COV通知のためのPresent_Valueの最小変化量, default 1.0	OW-N
Min_Pres_Value	0.0	O
Max_Pres_Value	102.4	O
Resolution	EWIO: 0.003125 % (0.3125 mV) MR-AO(P)4: 0.00625 % (0.625 mV)	-
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

出力が他のアプリケーションによって制御されている場合、**bacnet-server**はその出力を制御してはなりません。このため、オブジェクトを削除するか、サービス停止にすることができます。**Out-of-Service** に切り替えた場合、実際の出力値が **Interface_Value** プロパティに表示されます。

アナログ出力機能表						
Out_Of_Service	スイッチ	Priority_Array	Present_Value	Analog Output	OVER RIDDEN	OUT_OF_SERVICE
0	Auto	NULL	Relinquish_Default	Relinquish_Default	0	0
		Value	Value	Value		
0	Hand	NULL	Hand	Hand	1	0
		Value				
1	Auto	NULL	Relinquish_Default	unchanged	0	1
		Value	Value			
1	Hand	NULL	Relinquish_Default	Hand	0	1
		Value	Value			

5 アナログ入力、カウンタ、診断

5.1 アナログ入力オブジェクト 0...37

Instance 0...2: アナログ入力 E1 ... E3, 測定値
Instance 10...12: アナログ入力 E1 ..., 診断目的, 生計測
Instance 19: ADC ノイズ, 診断目的, 0 - 255
Instance 20...27: 周波数 DI1 ... DI8, バイナリ入力, 0.1 - 2000 Hz
Instance 28: 供給電圧, 診断目的, 20 - 24 V
Instance 29: Device 温度, 診断目的, 0 - 75 °C
Instance 30...37: Counter DI1 ... DI8, バイナリ入力, 64 bit counter

プロパティ	Remark / Value	Conf.
Object_Type	ANALOG_INPUT (0)	R
Object_Identifier	analog-input, instance 0 ... 37	R
Object_Name	max. 64 Bytes, default "Analog Input E1" ..., "Analog Input E1 Raw" ..., "ADC Noise", "Frequency DI1" ..., "Supply Voltage", "Device Temperature", "Counter DI1" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Device_Type	max. 64 Bytes, instance 0-2 default: selected State_Text of Multistate Value instance 19-37 default: ""	OW-N
-	creatable / deletable	-
Present_Value	Measured value, Measurement Range see above and in Multistate Value	R
Reliability	NO_FAULT_DETECTED (0) OVER_RANGE (2) / UNDER_RANGE (3) UNRELIABLE_OTHER (7) = hardware driver fault PROCESS_ERROR (8) = not calibrated, ADC fault COMMUNICATION_FAILURE (12) = no extension module	O
Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1)	RW-N

	if TRUE, Present_Value and Reliability are writable, not processed and decoupled from IO	
Units	see above and in Multistate Value	R
COV_Increment	Minimum change of Present_Value for COV notification, default 1.0	OW-N
Min_Pres_Value	see above and in Multistate Value	O
Max_Pres_Value	see above and in Multistate Value	O
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

アナログ入力 E1 ... E3 :

測定範囲は、同じインスタンスを持つ **Multistate-Values** で定義されます。
Min_Pres_Value、Max_Pres_Value、単位はレンジに応じて設定されます。

アナログ入力 E1 生... :

測定レンジは0 - 10 V / 40 Ω - 4 MΩ / 0 - 20 mA

レンジに応じてMin_Pres_Value、Max_Pres_Value、単位を設定。

周波数 DI1 ... DI8 :

デバウンス時間は入力信号の周波数範囲を制限します。

0に設定した場合、最大周波数は約2000Hzとなります。

カウンタ DI1 ... DI8 :

システム・カウンタは64ビットだが、アナログ入力オブジェクトの精度は24ビットに制限されています。

5.2 Multistate Value Object 0...2

Property	Remark / Value	Conf.
Object_Type	MULTISTATE_VALUE (19)	R
Object_Identifier	multistate-value, instance 0 ... 2	R
Object_Name	max. 64 Bytes, default "Measurement Range E1" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
State_Text	max. 32 Bytes, default see next Table	OW-N
-	creatable / deletable	-
Present_Value	Measurement Range of Analog Input 0...2, default State 3	RW-N
Reliability	NO_FAULT_DETECTED (0) UNRELIABLE_OTHER (7) = hardware driver fault COMMUNICATION_FAILURE (12) = no extension module	O

Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability are writable, not processed and decoupled from IO	RW-N
Number_Of_States	see next Table	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

If an input is controlled by another application, the bacnet-server must not control it too.
For this purpose the object may be deleted or switched out-of-service.

Multistate Value		Measurement Range of Analog Input		
State	State_Text	Units	Min_Pres_Value	Max_Pres_Value
1	"0-10V %"	percent (98)	0	100
2	"0-5V % Pullup"	percent (98)	0	50
3	"0-10 Volt"	volts (5)	0	10
4	"0-5 Volt Pullup"	volts (5)	0	5
5	"Ohm"	ohms (4)	40	4000000
6	"User Defined"	no-units (95)	0	0
7	"PT100"	degrees-celsius (62)	-50	150
8	"PT500"	degrees-celsius (62)	-50	150
9	"PT1000"	degrees-celsius (62)	-50	150
10	"NI1000-TC5000"	degrees-celsius (62)	-50	150
11	"NI1000-TC6180"	degrees-celsius (62)	-50	150
12	"BALCO500"	degrees-celsius (62)	-50	150
13	"KTY81_110"	degrees-celsius (62)	-50	150
14	"KTY81_210"	degrees-celsius (62)	-50	150
15	"NTC1k8 Thermokon"	degrees-celsius (62)	-50	150
16	"NTC5k Thermokon"	degrees-celsius (62)	-50	150
17	"NTC10k Thermokon"	degrees-celsius (62)	-50	150
18	"NTC20k Thermokon"	degrees-celsius (62)	-50	150
19	"LM235Z"	degrees-celsius (62)	-50	150
20	"NTC10k Carel"	degrees-celsius (62)	-50	110
21	"NTC5k Schneider"	degrees-celsius (62)	-50	150
22	"NTC30k Schneider"	degrees-celsius (62)	-50	150
23	"KP250"	degrees-celsius (62)	-50	150
24	"Poti 10k %"	percent (98)	0	100

Multistate Value		Measurement Range of Analog Input		
State	State_Text	Units	Min_Pres_Value	Max_Pres_Value
25	"Inactive"	no-units (95)	0	0
26	"0-20mA %"	percent (98)	0	100
27	"0-20mA"	milliamperes (2)	0	20
28	"4-20mA %"	percent (98)	0	100
29	"4-20mA"	milliamperes (2)	4	20
30	"3-wire sensing"	ohms (4)	0	14000
31	"4-wire sensing"	ohms (4)	0	14000
32	"40 Ohm - 14 kOhm"	ohms (4)	40	14000
33	"12 kOhm - 4 MOhm"	ohms (4)	12000	4000000
34	"40 Ohm - 650 Ohm"	ohms (4)	40	650
35	"500 Ohm - 14 kOhm"	ohms (4)	500	14000
36	"12 kOhm - 180 kOhm"	ohms (4)	12000	180000
37	"140 kOhm - 4 MOhm"	ohms (4)	140000	4000000

The characteristics of temperature sensors are listed at the end of this document.

Extension module MR-AI8, States 26...37:

Measurement is not supported. Instead the corresponding analog input is inactive.

Extension module MR-CI4: See usage of extension modules below.

6 User Defined Sensor

6.1 Analog Value Object 20...39

Property	Remark / Value	Conf.
Object_Type	ANALOG_VALUE (2)	R
Object_Identifier	analog-value, instance 20 ... 39	R
Object_Name	max. 64 bytes, default "X 1", "Y 1" ... "X 10", "Y 10"	RW-N
Property_List		R
Description	max. 255 bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	Interpolation table values in User Defined measurement range	RW-N
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Units	X1...X10: Units to use in Analog Input Object (default °C)	RW-N
	Y1...Y10: Defined in Multistate Value 18	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

Interpolation Table					
Instance	Name	Default Value	Instance	Name	Default Value
1	"X 1"	-10.0	2	"Y 1"	960.86
3	"X 2"	10.0	4	"Y 2"	1039.03
5	"X 3"	30.0	6	"Y 3"	1116.73
7	"X 4"	50.0	8	"Y 4"	1193.97
9	"X 5"	70.0	10	"Y 5"	1270.75
11	"X 6"	0.0	12	"Y 6"	0.0
13	"X 7"	0.0	14	"Y 7"	0.0
15	"X 8"	0.0	16	"Y 8"	0.0
17	"X 9"	0.0	18	"Y 9"	0.0
19	"X 10"	0.0	20	"Y 10"	0.0

The interpolation table by default provides an example for PT1000 temperature sensors.

In the example X values are temperature in °C, Y values are resistance in Ohms.

X and Y values must be sorted in ascending or descending order.

The table must be filled from its beginning.

By default it ends where both values are 0.

If $X = Y = 0$ is a valid pair, a different length may be chosen with Positive Integer Value 18.

The measurement range at the input must be selected in Multistate Value 18.

6.2 Multistate Value Object 18

Property	Remark / Value	Conf.
Object_Type	MULTISTATE_VALUE (19)	R
Object_Identifier	multistate-value, instance 18	R
Object_Name	max. 64 bytes, default "User Defined Range"	RW-N
Property_List		R
Description	max. 255 bytes, default ""	OW-N
State_Text	max. 20 bytes, default see next Table	OW-N
-	creatable / deletable	-
Present_Value	Selection of measurement range at input - Voltage (Volt) - Voltage, pullup resistor 2kOhm to 5V (Volt Pullup) - Resistance (Ohm) - Current (mA) and usage of interpolation table - approximately linear sensor (e.g. PT1000) - approximately exponential sensor (e.g. NTC) default 3, for PT1000 example	RW-N
Reliability	NO_FAULT_DETECTED (0)	O
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability are writable, not processed and decoupled from IO	RW-N
Number_Of_States	8	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

User Defined Range		
State	State_Text	Units of Analog Values Y
1	"Volt linear"	volts (5)
2	"Volt Pullup linear"	volts (5)
3	"Ohm linear"	ohms (4)
4	"mA linear"	milliamperes (2)
5	"Volt exp"	volts (5)

6	"Volt P exp"	volts (5)
7	"Ohm NTC exp"	ohms (4)
8	"mA exp"	milliamperes (2)

6.3 Positive Integer Value Object 18

Property	Remark / Value	Conf.
Object_Type	POSITIVE_INTEGER_VALUE (48)	R
Object_Identifier	positive-integer-value, instance 18	R
Object_Name	max. 64 Bytes, default "Interpolation Table Length"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	Interpolation table length of user defined sensor	RW-N
Units	no-units (95)	R
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Min_Pres_Value	0	R
Max_Pres_Value	10	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

By default the interpolation table of the user defined sensor ends where both X and Y values are 0. The currently counted length is shown in Present_Value of this object.

If X = Y = 0 is a valid pair, a different length 1...10 may be selected in Present_Value. The length may be counted again, after 0 is written to Present_Value.

7 Watchdog Timer

7.1 Analog Value Object 9

Property	Remark / Value	Conf.
Object_Type	ANALOG_VALUE (2)	R
Object_Identifier	analog-value, instance 9	R
Object_Name	max. 64 Bytes, default "Watchdog Time"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	Time Constant of Watchdog Timer, default 0, 0: Watchdog is inactive, Maximum: 655.35 seconds	RW-N
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Units	seconds (73)	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

The watchdog timer resets Present_Value of all output objects to Relinquish_Default, if BACnet communication fails permanently. The timer is restarted, when a BACnet message with an APDU is received. When the timer times out, the priority arrays of all output objects are completely cleared to NULL.

Each extension module with outputs also has a watchdog timer, which resets its outputs to their defaults, if communication between EWIO and extension module fails permanently.

8 Usage of Extension Modules

A unique address 1...6 must be selected for every extension module.

The following BACnet objects are used for the extension modules (BI = Binary-Input, BO = Binary-Output, AI = Analog-Input, AO = Analog-Output, MV = Multistate-Value). The BACnet objects only exist if extension modules are used.

Module Type	Adr 1	Adr 2 / 3 / 4 / 5	Adr 6
MR-DI10	BI 40...49	reserved instances 60 / 80 / 100 / 120 ... 79 / 99 / 119 / 139	BI 140...149
MR-DI4, MR-SI4	BI 40...43		BI 140...143
MR-DIO4/2	BI 40...43 BO 40...41		BI 140...143 BO 140...141
MR-DO4, MR-TO4	BO 40...43		BO 140...143
MR-AI8	AI 40...47 AI 50...57 MV 40...47		AI 140...147 AI 150...157 MV 140...147
MR-CI4	AI 40...43 AI 50...53 MV 40...43		AI 140...143 AI 150...153 MV 140...143
MR-AO4, MR-AOP4	AO 40...43		AO 140...143

Objects for extension modules have the following default names.

Objects	default Object_Name
BI	"Modbus Adr 1 Digital Input 1" ...
BO	"Modbus Adr 2 Digital Output 1" ...
AO	"Modbus Adr 3 Analog Output 1" ...
AI	"Modbus Adr 4 Analog Input 1" ...
AI	"Modbus Adr 4 Analog Input 1Raw " ...
MV	"Modbus Adr 4 Measurement Range 1" ...

Other properties of Binary-Inputs, Binary-Outputs, Multistate-Values, Analog-Inputs and Analog-Outputs are the same as those of the EWIO. Exceptions:

- The Binary-Outputs of MR-Modules can always be manually overridden.
- Module MR-AI8 does not support measurement in States 26 ... 37, instead the corresponding analog input is inactive. Module MR-CI4, see following table.

Multistate Value		Measurement Range of Analog Input MR-CI4		
State	State_Text	Units	Min_Pres_Value	Max_Pres_Value
1	"0-10V %"	percent (98)	0	100
2	"0-10 Volt"	volts (5)	0	10
3	"0-20mA %"	percent (98)	0	100
4	"0-20mA"	milliamperes (2)	0	20
5	"4-20mA %"	percent (98)	0	100
6	"4-20mA"	milliamperes (2)	4	20

Multistate Value Object 20...25

These Multistate-Values show which extension module types are used with address 1...6.

Property	Remark / Value	Conf.
Object_Type	MULTISTATE_VALUE (19)	R
Object_Identifier	multistate-value, instance 20 ... 25	R
Object_Name	max. 64 Bytes, default "MR Device Type Adr 0" ...	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
State_Text	max. 32 Bytes, default see next Table	OW-N
-	creatable / deletable	-
Present_Value	code for MR module type, default state 1	RW-N
Reliability	NO_FAULT_DETECTED (0) UNRELIABLE_OTHER (7) = hardware driver fault PROCESS_ERROR (8) = device driver not running COMMUNICATION_FAILURE (12) = no extension module	O
Status_Flags	IN_ALARM: 0 FAULT: 0 / 1 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability are writable, not processed and decoupled from IO	RW-N
Number_Of_States	11	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

Multistate Value 20...25	
State	State_Text
1	"none"
2	"MR-DO4"
3	"MR-TO4"
4	"MR-DI4"
5	"MR-DI10"
6	"MR-SI4"
7	"MR-DIO4/2"
8	"MR-AO4"
9	"MR-AOP4"
10	"MR-AI8"
11	"MR-CI4"

When MR devices are added or removed, these changes are not shown until a search for extension modules has been done by the device driver. This search may be started using Binary Value 1. BACnet objects used for the MR devices are added or removed then.

Changes to the configuration file are stored automatically for changed MR device types. When MR devices are removed permanently, state 1 (none) must be selected manually in Multistate-Value 20...25, to remove the MR devices from the configuration file. All BACnet objects used for the removed MR device are removed then.

8.1 Binary Value Object 0

This object shows the combined status of all extension modules in Present_Value.

- normal (0): Reliability of Multistate Value 20...25 is NO_FAULT_DETECTED.
- fault (1): Any of these Reliability values is other than NO_FAULT_DETECTED.

A broken connection to an extension module might be an error indicated in MV 20...25. This error is also shown in property Reliability of individual Input / Output objects.

Property	Remark / Value	Conf.
Object_Type	BINARY_VALUE (5)	R
Object_Identifier	binary-value, instance 0	R
Object_Name	max. 64 Bytes, default "MR Device Driver Status"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N

Inactive_Text	max. 32 Bytes, default "normal"	OW-N
Active_Text	max. 32 Bytes, default "fault"	OW-N
-	creatable / deletable	-
Present_Value	INACTIVE (0) / ACTIVE (1)	RW-V
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

8.2 Binary Value Object 1

With this object a search for extension modules by the device driver may be started.

Property	Remark / Value	Conf.
Object_Type	BINARY_VALUE (5)	R
Object_Identifier	binary-value, instance 1	R
Object_Name	max. 64 Bytes, default "MR Device Search"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
Inactive_Text	max. 32 Bytes, default "normal"	OW-N
Active_Text	max. 32 Bytes, default "search"	OW-N
-	creatable / deletable	-
Present_Value	INACTIVE (0) / ACTIVE (1)	RW-V
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

When Present_Value is set to ACTIVE, the device driver searches for extension modules. When the search is finished, Present_Value is reset to INACTIVE. The installed extension modules are shown then in Multistate Value 20...25.

9 Modbus Settings

9.1 Multistate Value Object 10...13

Property	Remark / Value	Conf.
Object_Type	MULTISTATE_VALUE (19)	R
Object_Identifier	multistate-value, instance 10 ... 13	R
Object_Name	max. 64 bytes, default "Modbus 1 Baud Rate", "Modbus 1 Parity Mode", "Modbus 2 Baud Rate", "Modbus 2 Parity Mode"	RW-N
Property_List		R
Description	max. 255 bytes, default ""	OW-N
State_Text	max. 20 bytes, baud rate default "1200", "2400", "4800", "9600", "19200", "38400", "57600", 115200" parity mode default "8e1", "8o1", "8n2", "8n1"	OW-N
-	creatable / deletable	-
Present_Value	Settings of the Modbus interfaces baud rate: default 8 (115200 baud) parity mode: default 1 (8 data bits, even parity, 1 stop bit)	RW-N
Reliability	NO_FAULT_DETECTED (0)	O
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value and Reliability are writable, not processed and decoupled from IO	RW-N
Number_Of_States	baud rate: 8 parity mode: 4	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

9.2 Positive Integer Value Object 20...23

Property	Remark / Value	Conf.
Object_Type	POSITIVE_INTEGER_VALUE (48)	R
Object_Identifier	positive-integer-value, instance 20 ... 23	R
Object_Name	max. 64 bytes, default "Modbus 1 Retries Count", "Modbus 1 Response Timeout", "Modbus 2 Retries Count", "Modbus 2 Response Timeout"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
-	creatable / deletable	-
Present_Value	Settings of the Modbus interfaces retries count: default 2 response timeout: default 100	RW-N
Units	retries count: no-units (95) response timeout: milliseconds (159)	R
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Min_Pres_Value	0	R
Max_Pres_Value	retries count: 10 response timeout: 5000	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

10 Trend Logging and Diagnostics

10.1 Trend Log Object 0

This Trend Log object may be used for diagnostic purpose. It stores 20 measured values of the supply voltage sampled in intervals of 1 ms. The stored values have a resolution of 0.2 V and are replaced every second.

Stored time stamps have intervals of 1 minute to support the display of BACnet explorers and because BACnet does not support intervals of a millisecond.

Property	Remark / Value	Conf.
Object_Type	TREND_LOG (20)	R
Object_Identifier	trend-log, instance 0	R
Object_Name	"Supply_Voltage_20ms"	R
Property_List		R
Description	""	O
-	not creatable / deletable	-
Enable	TRUE (1)	R
Stop_When_Full	FALSE (0)	R
Start_Time	unspecified	O
Stop_Time	unspecified	O
Log_DeviceObjectProperty	Device: this EWIO device, Object: analog-input 28 (Supply Voltage), Property: Present_Value	O
Log_Interval	0 hundredths of seconds	O
Logging_Type	LOG_TYPE_POLLED (0)	R
Buffer_Size	20	R
Record_Count	20	R
Total_Record_Count	20	R
Log_Buffer	readable only with service Read-Range	R
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0	R
Event_State	NORMAL (0)	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Files)		

10.2 Trend Log Object 1...400

A Trend Log object logs measured values or status together with timestamps in an internal buffer for subsequent retrieval.

Values periodically retrieved from M-Bus or Modbus devices or EWIO inputs or outputs are stored in an internal SQLite data base and subsequently in trend log buffers.

Configuration of M-Bus or Modbus properties is done via the web interface of the EWIO.

Property	Remark / Value	Conf.
Object_Type	TREND_LOG (20)	R
Object_Identifier	trend-log, instance 1...400	R-N
Object_Name	max. 64 Bytes, default "TREND LOG 1" ..., defined by Web-Interface, see below	R-N
Property_List		R
Description	max. 255 Bytes, defined by Web-Interface, see below	O-N
-	not creatable / deletable	-
Enable	FALSE (0) / TRUE (1)	RW-N
Stop_When_Full	FALSE (0) / TRUE (1)	RW-N
Start_Time	default: defined by Web-Interface, see below	OW-N
Stop_Time	default: unspecified	OW-N
Log_DeviceObjectProperty	Device: this EWIO device, Object: analog-value with instance 200 higher than trend-log, Property: Present_Value	O
Log_Interval	hundredths of seconds, defined by Web-Interface, see below	O-N
Logging_Type	LOG_TYPE_POLLED (0)	R
Buffer_Size	default 1000, maximum 1000000, writable only if Enable is FALSE, the Log_Buffer is cleared when written	RW-N
Record_Count	number of records currently in Log_Buffer, a write of 0 clears the Log_Buffer	RW-N
Total_Record_Count	number of records collected since creation	R-N
Log_Buffer	readable only with service Read-Range	R-N
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0	R
Event_State	NORMAL (0)	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Files)		

Object_Name, Description, Start_Time, Log_Interval: see below

10.3 Analog Value Object 201...600

These Analog Values may store additional information usable with the trend logs.

Property	Remark / Value	Conf.
Object_Type	ANALOG_VALUE (2)	R
Object_Identifier	analog-value, instance 201...600, instance is 200 higher than corresponding trend-log	R
Object_Name	max. 64 Bytes, default "ANALOG VALUE 1" ..., default is prefix "AV_" followed by name of trend-log	RW-N
Property_List		R
Description	max. 255 Bytes, default is same description as in trend-log	OW-N
-	not creatable / deletable	-
Present_Value	previously measured value stored in trend-log from EWIO / M-Bus device / Modbus device	R-N
Status_Flags	IN_ALARM: 0 FAULT: 0 OVERRIDDEN: 0 OUT_OF_SERVICE: 0 / 1	R
Event_State	NORMAL (0)	R
Out_Of_Service	FALSE (0) / TRUE (1) if TRUE, Present_Value is writable and not processed	RW-N
Units	physical unit of measured values in the trend log, default is defined by Web-Interface, see below	RW-N
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Files)		

Some properties of Trend-Log (TL) and Analog-Value (AV) are defined by the web interface:

Object	Property	Web Interface parameter
TL / AV	Object_Name	Name of data point (Datenpunkt / Beschreibung)
TL / AV	Description	Name of counter device (Zähler / Messstelle)
TL	Log_Interval	Interval (Datenpunkt / Intervall)
TL	Start_Time	Start time (Datenpunkt / Auslesen ab)
AV	Units	Unit (Datenpunkt / Einheit)

These web interface defined values are used as defaults, if special BACnet values are defined (empty String, unspecified Start_Time, no-units).

All writable Analog-Value properties and Trend-Log property Start_Time may be replaced using BACnet. These are BACnet server local values. The value defined by the web interface remains unchanged.

The default Object_Name is used if both BACnet and web interface defined names are empty.

In the Web-Interface a unit symbol like °C is entered. To translate this to BACnet units the configuration file /var/opt/etc/units.conf is used, which may be customized.

11 Configuration Files

11.1 File Object 0...5

The configuration files of the BACnet server and I/O drivers may be read and written while Backup and Restore operations using the services Atomic-Read-File and Atomic-Write-File. Outside Backup and Restore any access to the file data is prevented.

Property	Remark / Value	Conf.
Object_Type	FILE (10)	R
Object_Identifier	file, instance 0...5	R
Object_Name	max. 64 Bytes, default "Network_Configuration", "Object_Configuration", "BBMD_Configuration", "IoDriver_Configuration", "ExtModDriver1_Configuration", "ExtModDriver2_Configuration"	RW-N
Property_List		R
Description	max. 255 Bytes, default ""	OW-N
File_Type	max. 32 Bytes, default "Configuration"	RW-N
-	not creatable / deletable	-
File_Size	File-Size of file system, may be written with 0 while Restore procedure	RW-N
Modification_Date	Modification-Date of file system	R-N
Archive	Archive bit of file system, FALSE (0) / TRUE (1)	RW-N
Read_Only	Read-Only bit of file system, FALSE (0)	R-N
File_Access_Method	FILE_ACCESS_STREAM (1)	R
Conf.: R: Required, O: Optional, C: Conditional, W: Writable, P: Writable with Priority, Write: -V: Volatile, -N: Nonvolatile (Storage in Configuration File)		

12 Appendix: Temperature Sensor Characteristics

12.1 Table for PT- and NI-Sensors

Temp	PT100 TC3850	PT500 TC3850	PT1000 TC3850	NI1000 TC5000	NI1000 TC6180	BALCO500	KP250
°C	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm	Ohm
-50	80.306	401.53	803.06	790.88	742.55	361.65	196.5
-30	88.222	441.11	882.22	871.69	841.46	397.05	217.9
-10	96.086	480.43	960.86	956.24	945.82	433.96	239.3
10	103.903	519.51	1039.03	1044.79	1055.52	472.91	260.7
30	111.673	558.36	1116.73	1137.62	1170.56	513.89	282.1
50	119.397	596.99	1193.97	1234.98	1291.05	556.90	303.5
70	127.075	635.38	1270.75	1337.15	1417.21	601.94	324.9
90	134.707	673.53	1347.07	1444.39	1549.34	649.02	346.3
110	142.293	711.46	1422.93	1556.98	1687.89	698.13	367.7
130	149.832	749.16	1498.32	1675.19	1833.35	749.27	389.1
150	157.325	786.63	1573.25	1799.27	1986.35	802.44	410.5

12.2 Table for KTY81- and NTC-Sensors

Temp	KTY81 -110	KTY81 -210	NTC1k8 Thermokon	NTC5k Thermokon	NTC10k Thermokon	NTC20k Thermokon	NTC10k Carel	NTC5k Schneider	NTC30k Schneider
°C	Ohm	Ohm	Ohm	kOhm	kOhm	kOhm	kOhm	Ohm	kOhm
-50	515	1030		333.9	667.8	1668.0	329.5	9850	2497.83
-40	567	1135		167.8	335.7	813.4	188.5	9711	1219.17
-30	624	1247	24500	88.34	176.7	415.5	111.3	9465	622.94
-20	684	1367	14000	48.49	96.97	221.3	67.77	9066	331.02
-10	747	1495	8400	27.65	55.30	122.5	42.47	8471	183.56
0	815	1630	5200	16.33	32.65	70.20	27.28	7660	105.31
10	886	1772	3330	9.952	19.90	41.56	17.96	6666	62.355
20	961	1922	2200	6.247	12.49	25.35	12.09	5573	38.022
30	1040	2080	1480	4.028	8.06	15.89	8.31	4492	23.827
40	1122	2245	1040	2.662	5.32	10.21	5.83	3517	15.314
50	1209	2417	740	1.801	3.60	6.72	4.16	2702	10.077
60	1299	2597	540	1.244	2.49	4.52	3.02	2055	6.777
70	1392	2785	402	0.8758	1.75	3.10	2.23	1562	4.650
80	1490	2980	306	0.6281	1.26	2.12	1.67	1193	3.251
90	1591	3182	240	0.4581	0.92	1.54	1.27	921	2.312
100	1696	3392	187	0.3393	0.68	1.12	0.97	721	1.670
110	1805	3607	149	0.2550	0.51	0.82	0.76	574	1.224
120	1915	3817	118	0.1943	0.39	0.61		466	0.909
130	2023	4008	95	0.1499	0.30	0.46		380	0.690
140	2124	4166	77	0.1170	0.23	0.35		320	0.530
150	2211	4280	64	0.0924	0.18	0.27		270	0.410

12.3 Table for LM235Z Sensors

Temp	°C	-40	0	40	80	120
LM235Z	Volt	2.332	2.732	3.132	3.532	3.932