WM50

COMMUNICATION PROTOCOL

User version

rev. 1.0.0

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Revisions

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Version 1.0.0

First release

1 MAIN UNIT

1.1 Real time variables

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300081	0050h	2	V L1-N	32 bit IEEE 754		X0
300083	0052h	2	V L2-N	32 bit IEEE 754		X0
300085	0054h	2	V L3-N	32 bit IEEE 754		X0
300087	0056h	2	V L-N ∑	32 bit IEEE 754		X0
300089	0058h	2	V L1-L2	32 bit IEEE 754		X0
300091	005Ah	2	V L2-L3	32 bit IEEE 754		X0
300093	005Ch	2	V L3-L1	32 bit IEEE 754		X0
300095	005Eh	2	V L-L ∑	32 bit IEEE 754		X0
300097	0060h	2	A L1	32 bit IEEE 754		X0
300099	0062h	2	A L2	32 bit IEEE 754		X0
300101	0064h	2	A L3	32 bit IEEE 754		X0
300103	0066h	2	A N	32 bit IEEE 754	Calculated by instrument base	X0
					Measured by optional module	X0
300105	0068h	2	W L1	32 bit IEEE 754		X0
300107	006Ah	2	W L2	32 bit IEEE 754		X0
300109	006Ch	2	W L3	32 bit IEEE 754		X0
300111	006Eh	2	W ∑	32 bit IEEE 754		X0
300113	0070h	2	VA L1	32 bit IEEE 754		X0
300115	0072h	2	VA L2	32 bit IEEE 754		X0
300117	0074h	2	VA L3	32 bit IEEE 754		X0
300119	0076h	2	VA ∑	32 bit IEEE 754		X0
300121	0078h	2	VAR L1	32 bit IEEE 754		X0
300123	007Ah	2	VAR L2	32 bit IEEE 754		X0
300125	007Ch	2	VAR L3	32 bit IEEE 754		X0
300127	007Eh	2	VAR ∑	32 bit IEEE 754		X0
300129	0080h	2	PF L1	32 bit IEEE 754	Negative values correspond to lead(C), positive values correspond to lag(L)	X0
300131	0082h	2	PF L2	32 bit IEEE 754		
300133	0084h	2	PF L3	32 bit IEEE 754		
300135	0086h	2	PF ∑	32 bit IEEE 754		
300137	0088h	2	Hz	32 bit IEEE 754		X0
300139	008Ah	2	Asymmetry L-N %	32 bit IEEE 754		X0
300141	008Ch	2	Asymmetry L-L %	32 bit IEEE 754		X0
300143	008Eh	2	Phase sequence	32 bit IEEE 754	Value +1 corresponds to the L1-L2-L3 sequence, value -1 corresponds to wrong sequence	X0
300145	*0090h*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
300146	*0091h*	*1*	*RESERVED*	*UINT 16*		*X0*
300147	*0092h*	*1*	*RESERVED*	*UINT 16*		*X0*
300148	*0093h*	*1*	*RESERVED*	*UINT 16*		*X0*
300149	*0094h*	*1*	*RESERVED*	*UINT 16*		*X0*
300150	*0095h*	*1*	*RESERVED*	*UINT 16*		*X0*
300151	0096h	2	Temperature	32 bit IEEE 754	Only by optional module	X0
300153	0098h	2	Analogue Input	32 bit IEEE 754	Only by optional module	X0
300153	009Ah	2	A ∑	32 bit IEEE 754		X0
300161	00A0h	2	THD tot VL1-N	32 bit IEEE 754		X0
300163	00A2h	2	THD tot VL2-N	32 bit IEEE 754		X0
300165	00A4h	2	THD tot VL3-N	32 bit IEEE 754		X0
300167	00A6h	2	THD tot VL12	32 bit IEEE 754		X0
300169	00A8h	2	THD tot VL23	32 bit IEEE 754		X0
300171	00AAh	2	THD tot VL31	32 bit IEEE 754		X0
300173	00ACh	2	THD tot AL1	32 bit IEEE 754		X0
300175	00AEh	2	THD tot AL2	32 bit IEEE 754		X0
300177	00B0h	2	THD tot AL3	32 bit IEEE 754		X0
300179	00B2h	2	THD odd VL1-N	32 bit IEEE 754		X0
300181	00B4h	2	THD odd VL2-N	32 bit IEEE 754		X0
300183	00B6h	2	THD odd VL3-N	32 bit IEEE 754		X0
300185	00B8h	2	THD odd VL12	32 bit IEEE 754		X0
300187	00BAh	2	THD odd VL23	32 bit IEEE 754		X0
300189	00BCh	2	THD odd VL31	32 bit IEEE 754		X0
300191	00BEh	2	THD odd AL1	32 bit IEEE 754		X0
300193	00C0h	2	THD odd AL2	32 bit IEEE 754		X0
300195	00C2h	2	THD odd AL3	32 bit IEEE 754		X0
300197	00C4h	2	THD even VL1-N	32 bit IEEE 754		X0
300199	00C6h	2	THD even VL2-N	32 bit IEEE 754		X0
300201	00C8h	2	THD even VL3-N	32 bit IEEE 754		X0
300203	00CAh	2	THD even VL12	32 bit IEEE 754		X0
300205	00CCh	2	THD even VL23	32 bit IEEE 754		X0
300207	00CEh	2	THD even VL31	32 bit IEEE 754		X0

300209	00D0h	2	THD even AL1	32 bit IEEE 754		X0
300211	00D2h	2	THD even AL2	32 bit IEEE 754		X0
300213	00D4h	2	THD even AL3	32 bit IEEE 754		X0
300215	00D6h	2	TDD tot AL1	32 bit IEEE 754		X0
300217	00D8h	2	TDD tot AL2	32 bit IEEE 754		X0
300219	00DAh	2	TDD tot AL3	32 bit IEEE 754		X0

1.2 Min/ max/ min / max dmd variables

1.2.1 Maximum variables

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300337	0150h	2	Max V L1-N	32 bit IEEE 754		X0
300339	0152h	2	Max V L2-N	32 bit IEEE 754		X0
300341	0154h	2	Max V L3-N	32 bit IEEE 754		X0
300343	0156h	2	Max V L-N ∑	32 bit IEEE 754		X0
300345	0158h	2	Max V L1-L2	32 bit IEEE 754		X0
300347	015Ah	2	Max V L2-L3	32 bit IEEE 754		X0
300349	015Ch	2	Max V L3-L1	32 bit IEEE 754		X0
300351	015Eh	2	Max V L-L ∑	32 bit IEEE 754		X0
300353	0160h	2	Max A L1	32 bit IEEE 754		X0
300355	0162h	2	Max A L2	32 bit IEEE 754		X0
300357	0164h	2	Max A L3	32 bit IEEE 754		X0
300359	0166h	2	Max A N	32 bit IEEE 754		X0
300361	0168h	2	Max W L1	32 bit IEEE 754		X0
300363	016Ah	2	Max W L2	32 bit IEEE 754		X0
300365	016Ch	2	Max W L3	32 bit IEEE 754		X0
300367	016Eh	2	Max W ∑	32 bit IEEE 754		X0
300369	0170h	2	Max VA L1	32 bit IEEE 754		X0
300371	0172h	2	Max VA L2	32 bit IEEE 754		X0
300373	0174h	2	Max VA L3	32 bit IEEE 754		X0
300375	0176h	2	Max VA ∑	32 bit IEEE 754		X0
300377	0178h	2	Max VAR L1	32 bit IEEE 754		X0
300379	017Ah	2	Max VAR L2	32 bit IEEE 754		X0
300381	017Ch	2	Max VAR L3	32 bit IEEE 754		X0
300383	017Eh	2	Max VAR ∑	32 bit IEEE 754		X0
300385	0180h	2	Max PF L1	32 bit IEEE 754	Negative values correspond to lead(C), positive values correspond to lag(L)	X0
300387	0182h	2	Max PF L2	32 bit IEEE 754		
300389	0184h	2	Max PF L3	32 bit IEEE 754		
300391	0186h	2	Max PF ∑	32 bit IEEE 754		
300393	0188h	2	Max Hz	32 bit IEEE 754		X0
300395	018Ah	2	Max Asymmetry L-N %	32 bit IEEE 754		X0
300397	018Ch	2	Max Asymmetry L-L %	32 bit IEEE 754		X0
300399	*018Eh*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
300400	*018Fh*	*1*	*RESERVED*	*UINT 16*		*X0*
300401	*0190h*	*1*	*RESERVED*	*UINT 16*		*X0*
300402	*0191h*	*1*	*RESERVED*	*UINT 16*		*X0*
300403	*0192h*	*1*	*RESERVED*	*UINT 16*		*X0*
300404	*0193h*	*1*	*RESERVED*	*UINT 16*		*X0*
300405	*0194h*	*1*	*RESERVED*	*UINT 16*		*X0*
300406	*0195h*	*1*	*RESERVED*	*UINT 16*		*X0*
300407	0196h	2	Max Temperature	32 bit IEEE 754	Only by optional module	X0
300409	0198h	2	Max Analogue Input	32 bit IEEE 754	Only by optional module	X0
300411	019Ah	2	Max A ∑	32 bit IEEE 754		X0
300417	01A0h	2	Max THD tot VL1-N	32 bit IEEE 754		X0
300419	01A2h	2	Max THD tot VL2-N	32 bit IEEE 754		X0
300421	01A4h	2	Max THD tot VL3-N	32 bit IEEE 754		X0
300423	01A6h	2	Max THD tot VL12	32 bit IEEE 754		X0
300425	01A8h	2	Max THD tot VL23	32 bit IEEE 754		X0
300427	01AAh	2	Max THD tot VL31	32 bit IEEE 754		X0
300429	01ACh	2	Max THD tot AL1	32 bit IEEE 754		X0
300431	01AEh	2	Max THD tot AL2	32 bit IEEE 754		X0
300433	01B0h	2	Max THD tot AL3	32 bit IEEE 754		X0
300435	01B2h	2	Max THD odd VL1-N	32 bit IEEE 754		X0
300437	01B4h	2	Max THD odd VL2-N	32 bit IEEE 754		X0
300439	01B6h	2	Max THD odd VL3-N	32 bit IEEE 754		X0
300441	01B8h	2	Max THD odd VL12	32 bit IEEE 754		X0
300443	01BAh	2	Max THD odd VL23	32 bit IEEE 754		X0
300445	01BCh	2	Max THD odd VL31	32 bit IEEE 754		X0
300447	01BEh	2	Max THD odd AL1	32 bit IEEE 754		X0

300449	01C0h	2	Max THD odd AL2	32 bit IEEE 754		X0
300451	01C2h	2	Max THD odd AL3	32 bit IEEE 754		X0
300453	01C4h	2	Max THD even VL1-N	32 bit IEEE 754		X0
300455	01C6h	2	Max THD even VL2-N	32 bit IEEE 754		X0
300457	01C8h	2	Max THD even VL3-N	32 bit IEEE 754		X0
300459	01CAh	2	Max THD even VL12	32 bit IEEE 754		X0
300461	01CCh	2	Max THD even VL23	32 bit IEEE 754		X0
300463	01CEh	2	Max THD even VL31	32 bit IEEE 754		X0
300465	01D0h	2	Max THD even AL1	32 bit IEEE 754		X0
300467	01D2h	2	Max THD even AL2	32 bit IEEE 754		X0
300469	01D4h	2	Max THD even AL3	32 bit IEEE 754		X0
300471	01D6h	2	Max TDD tot AL1	32 bit IEEE 754		X0
300473	01D8h	2	Max TDD tot AL2	32 bit IEEE 754		X0
300475	01DAh	2	Max TDD tot AL3	32 bit IEEE 754		X0

1.2.2 Minimum variables

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300593	0250h	2	Min V L1-N	32 bit IEEE 754		X0
300595	0252h	2	Min V L2-N	32 bit IEEE 754		X0
300597	0254h	2	Min V L3-N	32 bit IEEE 754		X0
300599	0256h	2	Min V L-N ∑	32 bit IEEE 754		X0
300601	0258h	2	Min V L1-L2	32 bit IEEE 754		X0
300603	025Ah	2	Min V L2-L3	32 bit IEEE 754		X0
300605	025Ch	2	Min V L3-L1	32 bit IEEE 754		X0
300607	025Eh	2	Min V L-L ∑	32 bit IEEE 754		X0
300609	0260h	2	Min A L1	32 bit IEEE 754		X0
300611	0262h	2	Min A L2	32 bit IEEE 754		X0
300613	0264h	2	Min A L3	32 bit IEEE 754		X0
300615	0266h	2	Min A N	32 bit IEEE 754		X0
300617	0268h	2	Min W L1	32 bit IEEE 754		X0
300619	026Ah	2	Min W L2	32 bit IEEE 754		X0
300621	026Ch	2	Min W L3	32 bit IEEE 754		X0
300623	026Eh	2	Min W ∑	32 bit IEEE 754		X0
300625	0270h	2	Min VA L1	32 bit IEEE 754		X0
300627	0272h	2	Min VA L2	32 bit IEEE 754		X0
300629	0274h	2	Min VA L3	32 bit IEEE 754		X0
300631	0276h	2	Min VA ∑	32 bit IEEE 754		X0
300633	0278h	2	Min VAR L1	32 bit IEEE 754		X0
300635	027Ah	2	Min VAR L2	32 bit IEEE 754		X0
300637	027Ch	2	Min VAR L3	32 bit IEEE 754		X0
300639	027Eh	2	Min VAR ∑	32 bit IEEE 754		X0
300641	0280h	2	Min PF L1	32 bit IEEE 754	Negative values correspond to lead(C), positive values correspond to lag(L)	X0
300643	0282h	2	Min PF L2	32 bit IEEE 754		
300645	0284h	2	Min PF L3	32 bit IEEE 754		
300647	0286h	2	Min PF ∑	32 bit IEEE 754		
300649	0288h	2	Min Hz	32 bit IEEE 754		X0
300651	028Ah	2	Min Asymmetry L-N %	32 bit IEEE 754		X0
300653	028Ch	2	Min Asymmetry L-L %	32 bit IEEE 754		X0
300655	*028Eh*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
300656	*028Fh*	*1*	*RESERVED*	*UINT 16*		*X0*
300657	*0290h*	*1*	*RESERVED*	*UINT 16*		*X0*
300658	*0291h*	*1*	*RESERVED*	*UINT 16*		*X0*
300659	*0292h*	*1*	*RESERVED*	*UINT 16*		*X0*
300660	*0293h*	*1*	*RESERVED*	*UINT 16*		*X0*
300661	*0294h*	*1*	*RESERVED*	*UINT 16*		*X0*
300662	*0295h*	*1*	*RESERVED*	*UINT 16*		*X0*
300663	0296h	2	Min Temperature	32 bit IEEE 754	Only by optional module	X0
300665	0298h	2	Min Analogue Input	32 bit IEEE 754	Only by optional module	X0
300667	029Ah	2	Min A ∑	32 bit IEEE 754		X0
300673	02A0h	2	Min THD tot VL1-N	32 bit IEEE 754		X0
300675	02A2h	2	Min THD tot VL2-N	32 bit IEEE 754		X0
300677	02A4h	2	Min THD tot VL3-N	32 bit IEEE 754		X0
300679	02A6h	2	Min THD tot VL12	32 bit IEEE 754		X0
300681	02A8h	2	Min THD tot VL23	32 bit IEEE 754		X0
300683	02AAh	2	Min THD tot VL31	32 bit IEEE 754		X0
300685	02ACh	2	Min THD tot AL1	32 bit IEEE 754		X0
300687	02AEh	2	Min THD tot AL2	32 bit IEEE 754		X0
300689	02B0h	2	Min THD tot AL3	32 bit IEEE 754		X0
300691	02B2h	2	Min THD odd VL1-N	32 bit IEEE 754		X0
300693	02B4h	2	Min THD odd VL2-N	32 bit IEEE 754		X0

300695	02B6h	2	Min THD odd VL3-N	32 bit IEEE 754		X0
300697	02B8h	2	Min THD odd VL12	32 bit IEEE 754		X0
300699	02BAh	2	Min THD odd VL23	32 bit IEEE 754		X0
300701	02BCh	2	Min THD odd VL31	32 bit IEEE 754		X0
300703	02BEh	2	Min THD odd AL1	32 bit IEEE 754		X0
300705	02C0h	2	Min THD odd AL2	32 bit IEEE 754		X0
300707	02C2h	2	Min THD odd AL3	32 bit IEEE 754		X0
300709	02C4h	2	Min THD even VL1-N	32 bit IEEE 754		X0
300711	02C6h	2	Min THD even VL2-N	32 bit IEEE 754		X0
300713	02C8h	2	Min THD even VL3-N	32 bit IEEE 754		X0
300715	02CAh	2	Min THD even VL12	32 bit IEEE 754		X0
300717	02CCh	2	Min THD even VL23	32 bit IEEE 754		X0
300719	02CEh	2	Min THD even VL31	32 bit IEEE 754		X0
300721	02D0h	2	Min THD even AL1	32 bit IEEE 754		X0
300723	02D2h	2	Min THD even AL2	32 bit IEEE 754		X0
300725	02D4h	2	Min THD even AL3	32 bit IEEE 754		X0
300727	02D6h	2	Min TDD tot AL1	32 bit IEEE 754		X0
300729	02D8h	2	Min TDD tot AL2	32 bit IEEE 754		X0
300731	02DAh	2	Min TDD tot AL3	32 bit IEEE 754		X0

1.2.3 DMD variables

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300849	0350h	2	DMD V L1-N	32 bit IEEE 754		X0
300851	0352h	2	DMD V L2-N	32 bit IEEE 754		X0
300853	0354h	2	DMD V L3-N	32 bit IEEE 754		X0
300855	0356h	2	DMD V L-N ∑	32 bit IEEE 754		X0
300857	0358h	2	DMD V L1-L2	32 bit IEEE 754		X0
300859	035Ah	2	DMD V L2-L3	32 bit IEEE 754		X0
300861	035Ch	2	DMD V L3-L1	32 bit IEEE 754		X0
300863	035Eh	2	DMD V L-L ∑	32 bit IEEE 754		X0
300865	0360h	2	DMD A L1	32 bit IEEE 754		X0
300867	0362h	2	DMD A L2	32 bit IEEE 754		X0
300869	0364h	2	DMD A L3	32 bit IEEE 754		X0
300871	0366h	2	DMD A N	32 bit IEEE 754		X0
300873	0368h	2	DMD W L1	32 bit IEEE 754		X0
300875	036Ah	2	DMD W L2	32 bit IEEE 754		X0
300877	036Ch	2	DMD W L3	32 bit IEEE 754		X0
300879	036Eh	2	DMD W ∑	32 bit IEEE 754		X0
300881	0370h	2	DMD VA L1	32 bit IEEE 754		X0
300883	0372h	2	DMD VA L2	32 bit IEEE 754		X0
300885	0374h	2	DMD VA L3	32 bit IEEE 754		X0
300887	0376h	2	DMD VA ∑	32 bit IEEE 754		X0
300889	0378h	2	DMD VAR L1	32 bit IEEE 754		X0
300891	037Ah	2	DMD VAR L2	32 bit IEEE 754		X0
300893	037Ch	2	DMD VAR L3	32 bit IEEE 754		X0
300895	037Eh	2	DMD VAR ∑	32 bit IEEE 754		X0
300897	0380h	2	DMD PF L1	32 bit IEEE 754	Negative values correspond to lead(C), positive values correspond to lag(L)	X0
300899	0382h	2	DMD PF L2	32 bit IEEE 754		
300901	0384h	2	DMD PF L3	32 bit IEEE 754		
300903	0386h	2	DMD PF ∑	32 bit IEEE 754		
300905	0388h	2	DMD Hz	32 bit IEEE 754		X0
300907	038Ah	2	DMD Asymmetry L-N %	32 bit IEEE 754		X0
300909	038Ch	2	DMD Asymmetry L-L %	32 bit IEEE 754		X0
301911	*038Eh*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
301912	*038Fh*	*1*	*RESERVED*	*UINT 16*		*X0*
301913	*0390h*	*1*	*RESERVED*	*UINT 16*		*X0*
301914	*0391h*	*1*	*RESERVED*	*UINT 16*		*X0*
301915	*0392h*	*1*	*RESERVED*	*UINT 16*		*X0*
301916	*0393h*	*1*	*RESERVED*	*UINT 16*		*X0*
301917	*0394h*	*1*	*RESERVED*	*UINT 16*		*X0*
301918	*0395h*	*1*	*RESERVED*	*UINT 16*		*X0*
300919	0396h	2	DMD Temperature	32 bit IEEE 754	Only by optional module	X0
300921	0398h	2	DMD Analogue Input	32 bit IEEE 754	Only by optional module	X0
300923	039Ah	2	DMD A ∑	32 bit IEEE 754		X0
300929	03A0h	2	DMD THD tot VL1-N	32 bit IEEE 754		X0
300931	03A2h	2	DMD THD tot VL2-N	32 bit IEEE 754		X0
300933	03A4h	2	DMD THD tot VL3-N	32 bit IEEE 754		X0
300935	03A6h	2	DMD THD tot VL12	32 bit IEEE 754		X0
300937	03A8h	2	DMD THD tot VL23	32 bit IEEE 754		X0
300939	03AAh	2	DMD THD tot VL31	32 bit IEEE 754		X0

300941	03ACh	2	DMD THD tot AL1	32 bit IEEE 754		X0
300943	03AEh	2	DMD THD tot AL2	32 bit IEEE 754		X0
300945	03B0h	2	DMD THD tot AL3	32 bit IEEE 754		X0
300947	03B2h	2	DMD THD odd VL1-N	32 bit IEEE 754		X0
300949	03B4h	2	DMD THD odd VL2-N	32 bit IEEE 754		X0
300951	03B6h	2	DMD THD odd VL3-N	32 bit IEEE 754		X0
300953	03B8h	2	DMD THD odd VL12	32 bit IEEE 754		X0
300955	03BAh	2	DMD THD odd VL23	32 bit IEEE 754		X0
300957	03BCh	2	DMD THD odd VL31	32 bit IEEE 754		X0
300959	03BEh	2	DMD THD odd AL1	32 bit IEEE 754		X0
300961	03C0h	2	DMD THD odd AL2	32 bit IEEE 754		X0
300963	03C2h	2	DMD THD odd AL3	32 bit IEEE 754		X0
300965	03C4h	2	DMD THD even VL1-N	32 bit IEEE 754		X0
300967	03C6h	2	DMD THD even VL2-N	32 bit IEEE 754		X0
300969	03C8h	2	DMD THD even VL3-N	32 bit IEEE 754		X0
300971	03CAh	2	DMD THD even VL12	32 bit IEEE 754		X0
300973	03CCh	2	DMD THD even VL23	32 bit IEEE 754		X0
300975	03CEh	2	DMD THD even VL31	32 bit IEEE 754		X0
300977	03D0h	2	DMD THD even AL1	32 bit IEEE 754		X0
300979	03D2h	2	DMD THD even AL2	32 bit IEEE 754		X0
300981	03D4h	2	DMD THD even AL3	32 bit IEEE 754		X0
300983	03D6h	2	DMD TDD tot AL1	32 bit IEEE 754		X0
300985	03D8h	2	DMD TDD tot AL2	32 bit IEEE 754		X0
300987	03DAh	2	DMD TDD tot AL3	32 bit IEEE 754		X0

1.2.4 Maximum DMD variables

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
301105	0450h	2	DMD Max V L1-N	32 bit IEEE 754		X0
301107	0452h	2	DMD Max V L2-N	32 bit IEEE 754		X0
301109	0454h	2	DMD Max V L3-N	32 bit IEEE 754		X0
301111	0456h	2	DMD Max V L-N ∑	32 bit IEEE 754		X0
301113	0458h	2	DMD Max V L1-L2	32 bit IEEE 754		X0
301115	045Ah	2	DMD Max V L2-L3	32 bit IEEE 754		X0
301117	045Ch	2	DMD Max V L3-L1	32 bit IEEE 754		X0
301119	045Eh	2	DMD Max V L-L ∑	32 bit IEEE 754		X0
301121	0460h	2	DMD Max A L1	32 bit IEEE 754		X0
301123	0462h	2	DMD Max A L2	32 bit IEEE 754		X0
301125	0464h	2	DMD Max A L3	32 bit IEEE 754		X0
301127	0466h	2	DMD Max A N	32 bit IEEE 754		X0
301129	0468h	2	DMD Max W L1	32 bit IEEE 754		X0
301131	046Ah	2	DMD Max W L2	32 bit IEEE 754		X0
301133	046Ch	2	DMD Max W L3	32 bit IEEE 754		X0
301135	046Eh	2	DMD Max W ∑	32 bit IEEE 754		X0
301137	0470h	2	DMD Max VA L1	32 bit IEEE 754		X0
301139	0472h	2	DMD Max VA L2	32 bit IEEE 754		X0
301141	0474h	2	DMD Max VA L3	32 bit IEEE 754		X0
301143	0476h	2	DMD Max VA ∑	32 bit IEEE 754		X0
301145	0478h	2	DMD Max VAR L1	32 bit IEEE 754		X0
301147	047Ah	2	DMD Max VAR L2	32 bit IEEE 754		X0
301149	047Ch	2	DMD Max VAR L3	32 bit IEEE 754		X0
301151	047Eh	2	DMD Max VAR ∑	32 bit IEEE 754		X0
301153	0480h	2	DMD Max PF L1	32 bit IEEE 754	Negative values correspond to lead(C), positive values correspond to lag(L)	X0
301155	0482h	2	DMD Max PF L2	32 bit IEEE 754		
301157	0484h	2	DMD Max PF L3	32 bit IEEE 754		
301159	0486h	2	DMD Max PF ∑	32 bit IEEE 754		
301161	0488h	2	DMD Max Hz	32 bit IEEE 754		X0
301163	048Ah	2	DMD Max Asymmetry L-N %	32 bit IEEE 754		X0
301165	048Ch	2	DMD Max Asymmetry L-L %	32 bit IEEE 754		X0
301167	*048Eh*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
301168	*048Fh*	*1*	*RESERVED*	*UINT 16*		*X0*
301169	*0490h*	*1*	*RESERVED*	*UINT 16*		*X0*
301170	*0491h*	*1*	*RESERVED*	*UINT 16*		*X0*
301171	*0492h*	*1*	*RESERVED*	*UINT 16*		*X0*
301172	*0493h*	*1*	*RESERVED*	*UINT 16*		*X0*
301173	*0494h*	*1*	*RESERVED*	*UINT 16*		*X0*
301174	*0495h*	*1*	*RESERVED*	*UINT 16*		*X0*
301175	0496h	2	DMD Max Temperature	32 bit IEEE 754	Only by optional module	X0
301177	0498h	2	DMD Max Analogue Input	32 bit IEEE 754	Only by optional module	X0
301179	049Ah	2	DMD Max A ∑	32 bit IEEE 754		X0
301185	04A0h	2	DMD MAX THD tot VL1-N	32 bit IEEE 754		X0

301187	04A2h	2	DMD MAX THD tot VL2-N	32 bit IEEE 754		X0
301189	04A4h	2	DMD MAX THD tot VL3-N	32 bit IEEE 754		X0
301191	04A6h	2	DMD MAX THD tot VL12	32 bit IEEE 754		X0
301193	04A8h	2	DMD MAX THD tot VL23	32 bit IEEE 754		X0
301195	04AAh	2	DMD MAX THD tot VL31	32 bit IEEE 754		X0
301197	04ACh	2	DMD MAX THD tot AL1	32 bit IEEE 754		X0
301199	04AEh	2	DMD MAX THD tot AL2	32 bit IEEE 754		X0
301201	04B0h	2	DMD MAX THD tot AL3	32 bit IEEE 754		X0
301203	04B2h	2	DMD MAX THD odd VL1-N	32 bit IEEE 754		X0
301205	04B4h	2	DMD MAX THD odd VL2-N	32 bit IEEE 754		X0
301207	04B6h	2	DMD MAX THD odd VL3-N	32 bit IEEE 754		X0
301209	04B8h	2	DMD MAX THD odd VL12	32 bit IEEE 754		X0
301211	04BAh	2	DMD MAX THD odd VL23	32 bit IEEE 754		X0
301213	04BCh	2	DMD MAX THD odd VL31	32 bit IEEE 754		X0
301215	04BEh	2	DMD MAX THD odd AL1	32 bit IEEE 754		X0
301217	04C0h	2	DMD MAX THD odd AL2	32 bit IEEE 754		X0
301219	04C2h	2	DMD MAX THD odd AL3	32 bit IEEE 754		X0
301221	04C4h	2	DMD MAX THD even VL1-N	32 bit IEEE 754		X0
301223	04C6h	2	DMD MAX THD even VL2-N	32 bit IEEE 754		X0
301225	04C8h	2	DMD MAX THD even VL3-N	32 bit IEEE 754		X0
301227	04CAh	2	DMD MAX THD even VL12	32 bit IEEE 754		X0
301229	04CCh	2	DMD MAX THD even VL23	32 bit IEEE 754		X0
301231	04CEh	2	DMD MAX THD even VL31	32 bit IEEE 754		X0
301233	04D0h	2	DMD MAX THD even AL1	32 bit IEEE 754		X0
301235	04D2h	2	DMD MAX THD even AL2	32 bit IEEE 754		X0
301237	04D4h	2	DMD MAX THD even AL3	32 bit IEEE 754		X0
301239	04D6h	2	DMD MAX TDD tot AL1	32 bit IEEE 754		X0
301241	04D8h	2	DMD MAX TDD tot AL2	32 bit IEEE 754		X0
301243	04DAh	2	DMD MAX TDD tot AL3	32 bit IEEE 754		X0

1.3 Total and partial (tariff) energy meters

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
301281	0500h	4	Total KWh+	UINT 64	Values in Wh or varh	X0
301285	0504h	4	Total Kvarh+	UINT 64		
301289	0508h	4	Total KWh-	UINT 64		
301293	050Ch	4	Total Kvarh-	UINT 64		
301297	0510h	4	Partial KWh+	UINT 64		
301301	0514h	4	Partial Kvarh+	UINT 64		
301305	0518h	4	Partial KWh-	UINT 64		
301309	051Ch	4	Partial Kvarh-	UINT 64		
301313	0520h	4	Hours counter	UINT 64	Hours value: integer part got from the division of the counter by 100 Minutes value: rest of the previous computation (decimal part)	X0
301317	0524h	4	Tariff 1 KWh+	UINT 64	Values in Wh or varh.	X0
301321	0528h	4	Tariff 1 Kvarh+	UINT 64		
301325	052Ch	4	Tariff 1 KWh-	UINT 64		
301329	0530h	4	Tariff 1 Kvarh-	UINT 64		
301333	0534h	4	Tariff 2 KWh+	UINT 64		
301337	0538h	4	Tariff 2 Kvarh+	UINT 64		
301341	053Ch	4	Tariff 2 KWh-	UINT 64		
301345	0540h	4	Tariff 2 Kvarh-	UINT 64		
301349	0544h	4	Tariff 3 KWh+	UINT 64		
301353	0548h	4	Tariff 3 Kvarh+	UINT 64		
301357	054Ch	4	Tariff 3 KWh-	UINT 64		
301361	0550h	4	Tariff 3 Kvarh-	UINT 64		
301365	0554h	4	Tariff 4 KWh+	UINT 64		
301369	0558h	4	Tariff 4 Kvarh+	UINT 64		
301373	055Ch	4	Tariff 4 KWh-	UINT 64		
301377	0560h	4	Tariff 4 Kvarh-	UINT 64		
301381	0564h	4	Tariff 5 KWh+	UINT 64		
301385	0568h	4	Tariff 5 Kvarh+	UINT 64		
301389	056Ch	4	Tariff 5 KWh-	UINT 64		
301393	0570h	4	Tariff 5 Kvarh-	UINT 64		
301397	0574h	4	Tariff 6 KWh+	UINT 64		
301401	0578h	4	Tariff 6 Kvarh+	UINT 64		
301405	057Ch	4	Tariff 6 KWh-	UINT 64		
301409	0580h	4	Tariff 6 Kvarh-	UINT 64		
301413	0584h	4	C-1 (totalizer linked to input 4)	UINT 64	Only by optional module.	

301417	0588h	4	C-2 (totalizer linked to input 5)	UINT 64	Values multiplied by 1000.	
301421	058Ch	4	C-3 (totalizer linked to input 6)	UINT 64		
301521	05F0h	1	Real Time tariff	UINT 16	Tariff1 0 Tariff2 1 Tariff3 2 Tariff4 3 Tariff5 4 Tariff6 5 Tariff_Disable 6	

1.4 Harmonic analysis

MODBUS: read only mode (with functions code 03 and 04)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
301537	0600h	71	V L1-N	Custom Harmonic data structure		
301617	0650h	71	V L2-N	Custom Harmonic data structure		
301697	06A0h	71	V L3-N	Custom Harmonic data structure		
301777	06F0h	71	V L1-L2	Custom Harmonic data structure		
301857	0740h	71	V L2-L3	Custom Harmonic data structure		X0
301937	0790h	71	V L3-L1	Custom Harmonic data structure		
302017	07E0h	71	A L1	Custom Harmonic data structure		
302097	0830h	71	A L2	Custom Harmonic data structure		
302177	0880h	71	A L3	Custom Harmonic data structure		

Custom Harmonic data structure Table 2.10-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
Block address +0	Block address +0	1	Number of sample	UINT 16		X0
Block address +1	Block address +1	2	Frequency	32 bit IEEE 754		X0
Block address +3	Block address +3	2	RMS value	32 bit IEEE 754		X0
Block address +5	Block address +5	1	Re (FFT_0)	INT 16		X0
Block address +6	Block address +6	1	Re (FFT_1)	INT 16		X0
...	...	...	...	...	...	X0
Block address +36	Block address +36	1	Re (FFT_{31})	INT 16		X0
Block address +37	Block address +37	1	Reserved	INT 16	Always 0	X0
Block address +38	Block address +38	1	Im (FFT_0)	INT 16		X0
Block address +39	Block address +39	1	Im (FFT_1)	INT 16		X0
...	...	...	...	...	...	X0

Block address +69	Block address +69	1	Im (FFT_{31})	INT 16		X0
Block address +70	Block address +70	1	Reserved	INT 16	**Always 0**	X0

NOTE: In order to calculate a single harmonics (order n), 4 values are required:

- Real part of the harmonics: Re(FFT(n))
- Imaginary part of the harmonics: Im(FFT(n))
- Real part of the harmonics 1 (fundamental): Re(FFT(1))
- Imaginary part of the harmonics 1 (fundamental): Im(FFT(1))

The value (expressed in respect to the fundamental) of the harmonic n is

$$H^{n}_{\%} = \frac{\sqrt{\left(Re(FFT_n)\right)^2 + \left(Im(FFT_n)\right)^2}}{\sqrt{\left(Re(FFT_1)\right)^2 + \left(Im(FFT_1)\right)^2}} \cdot 100\ \%$$

Example: How to calculate the VL2-N 5th harmonics

- Re(FFT(5))=0650h+5+5=065Ah
- Im(FFT(5))= 0650h+39+5=067Bh
- Re(FFT(1))= 0650h+5+1=0655h
- Im(FFT(1))= 0650h+38+1=0677h

$$H^{5}(V_{L2-N})_{\%} = \frac{\sqrt{065Ah^2 + 067Bh^2}}{\sqrt{0655h^2 + 0677h^2}} \cdot 100\ \%$$

1.4.1 Harmonic phase angles

MODBUS: read only mode with functions code 03 and 04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
302305	0900h	1	1° harmonic Ph. Angle VL1-N→AL1 [°]	UINT 16		X0
302306	0901h	1	2° harmonic Ph. Angle VL1-N→AL1 [°]	UINT 16		X0
…	…	…	…			X0
302334	091Dh	1	30° harmonic Ph. Angle VL1-N→AL1 [°]	UINT 16		X0
302335	091Eh	1	31° harmonic Ph. Angle VL1-N→AL1 [°]	UINT 16		X0
302336	091Fh	1	Reserved	INT 16	**Always 0**	X0
302337	0920h	1	1° harmonic Ph. Angle VL2-N→AL2 [°]	UINT 16		X0
302338	0921h	1	2° harmonic Ph. Angle VL2-N→AL2 [°]	UINT 16		X0
…	…	…	…			X0
302366	093Dh	1	30° harmonic Ph. Angle VL2-N→AL2 [°]	UINT 16		X0
302367	093Eh	1	31° harmonic Ph. Angle VL2-N→AL2 [°]	UINT 16		X0
302368	093Fh	1	Reserved	INT 16	**Always 0**	X0
302369	0940h	1	1° harmonic Ph. Angle VL3-N→AL3 [°]	UINT 16		X0
302370	0941h	1	2° harmonic Ph. Angle VL3-N→AL3 [°]	UINT 16		X0
…	…	…	…			X0
302398	095Dh	1	30° harmonic Ph. Angle VL3-N→AL3 [°]	UINT 16		X0
302399	095Eh	1	31° harmonic Ph. Angle VL3-N→AL3 [°]	UINT 16		X0
302400	095Fh	1	Reserved	INT 16	**Always 0**	X0

1.5 Clock

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Default	FW
304358	1105h	1	(*) Clock calendar: Year	UINT 16	2017÷2099		X0
304359	1106h	1	(*) Clock calendar: Month	UINT 16	1÷12		X0
304360	1107h	1	(*) Clock calendar: Day	UINT 16	1÷31		X0
304361	1108h	1	(*) Clock: Hour	UINT 16	0÷23		X0
304362	1109h	1	(*) Clock: Minutes	UINT 16	0÷59		X0
304363	110Ah	1	(*) Clock: Seconds	UINT 16	0÷59		X0

(*) The values are updated only after sending the “update clock” command.

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
312369	3050h	1	Update clock	UINT 16	Value=1: command executed Value≠1: no effect	X0

1.6 Commands

1.6.1 Tariff selection via Modbus command

MODBUS: Read and write mode

305184	143Fh	1	Default Tariff	UINT16	Value=0: tariff 1 Value=1: tariff 2 Value=2: tariff 3 Value=3: tariff 4 Value=4: tariff 5 Value=5: tariff 6 Value=6: disabled Reference tariff in case of wrong programming (**)	6	X0

In case of Tariff management set as “default tariff”-“remote command”. See instruction manual.

1.6.2 Alarm/output commands

MODBUS: Read and write mode

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
312549	3104h	1	Reset (open) all remote outputs (each digital output set as REMOTE is opened) (**MFI6O6 / MFI6R4**)	UINT 16	Value=1: open Value≠1: no effect	X0
312550	3105h	1	Remote output command on port 1 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312551	3106h	1	Remote output command on port 2 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312552	3107h	1	Remote output command on port 3 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312553	3108h	1	Remote output command on port 4 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312554	3109h	1	Remote output command on port 5 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312555	310Ah	1	Remote output command on port 6 (**MFI6O6 / MFI6R4**)	UINT 16	Value=0: open Value=1: close Other values: no effect	X0
312556	310Bh	1	Set (close) all remote outputs (each digital output set as REMOTE is closed) (**MFI6O6 / MFI6R4**)	UINT 16	Value=1: close Value≠1: no effect	X0
312625	3150h	1	Reset all latch status (main unit virtual alarms)	UINT 16	Value=1: command executed Value≠1: no effect NOTE: Each alarm in latch status, but with the linked variable out of the alarm condition, is reset.	X0

1.6.3 Reset min/ max/ dmd/ dmd max

312801	3200h	1	Reset V L1-N	UINT 16	Bit0 = Max Value (X0) Bit1 = DMD (X0) Bit2 = DMD Max Value (X0) Bit3 = Min Value (X0) Where the bit is set to “1”, there is reset See note (**)
312802	3201h	1	Reset V L2-N	UINT 16	
312803	3202h	1	Reset V L3-N	UINT 16	
312804	3203h	1	Reset V L-N ∑	UINT 16	
312805	3204h	1	Reset V L1-L2	UINT 16	
312806	3205h	1	Reset V L2-L3	UINT 16	
312807	3206h	1	Reset V L3-L1	UINT 16	
312808	3207h	1	Reset V L-L ∑	UINT 16	
312809	3208h	1	Reset A L1	UINT 16	
312810	3209h	1	Reset A L2	UINT 16	
312811	320Ah	1	Reset A L3	UINT 16	
312812	320Bh	1	Reset A N	UINT 16	
312813	320Ch	1	Reset W L1	UINT 16	
312814	320Dh	1	Reset W L2	UINT 16	
312815	320Eh	1	Reset W L3	UINT 16	
312816	320Fh	1	Reset W ∑	UINT 16	
312817	3210h	1	Reset VA L1	UINT 16	
312818	3211h	1	Reset VA L2	UINT 16	

312819	3212h	1	Reset VA L3	UINT 16	
312820	3213h	1	Reset VA ∑	UINT 16	
312821	3214h	1	Reset VAR L1	UINT 16	
312822	3215h	1	Reset VAR L2	UINT 16	
312823	3216h	1	Reset VAR L3	UINT 16	
312824	3217h	1	Reset VAR ∑	UINT 16	
312825	3218h	1	Reset PF L1	UINT 16	
312826	3219h	1	Reset PF L2	UINT 16	
312827	321Ah	1	Reset PF L3	UINT 16	
312828	321Bh	1	Reset PF ∑	UINT 16	
312829	321Ch	1	Reset Hz	UINT 16	
312830	321Dh	1	Reset Asymmetry L-N %	UINT 16	
312831	321Eh	1	Reset Asymmetry L-L %	UINT 16	
312832	*321Fh*	*1*	*Reserved*	*UINT 16*	*Always writable. Do nothing*
312833	*3220h*	*1*	*Reserved*	*UINT 16*	
312834	*3221h*	*1*	*Reserved*	*UINT 16*	
312835	*3222h*	*1*	*Reserved*	*UINT 16*	
312836	3223h	1	Reset Temperature	UINT 16	Bit1 = Max Value (X0) Bit2 = DMD (X0) Bit3 = DMD Max Value (X0) Bit4 = Min Value (X0) Where the bit is set to "1" there is reset See note (**)
312837	3224h	1	Reset analogue input	UINT 16	
312838	3225h	1	Reset A ∑	UINT 16	
312839	3226h	1	THD tot VL1-N	UINT 16	
312840	3227h	1	THD tot VL2-N	UINT 16	
312841	3228h	1	THD tot VL3-N	UINT 16	
312842	3229h	1	THD tot VL12	UINT 16	
312843	322Ah	1	THD tot VL23	UINT 16	
312844	322Bh	1	THD tot VL31	UINT 16	
312845	322Ch	1	THD tot AL1	UINT 16	
312846	322Dh	1	THD tot AL2	UINT 16	
312847	322Eh	1	THD tot AL3	UINT 16	
312848	322Fh	1	THD even VL1-N	UINT 16	
312849	3230h	1	THD even VL2-N	UINT 16	
312850	3231h	1	THD even VL3-N	UINT 16	
312851	3232h	1	THD even VL12	UINT 16	
312852	3233h	1	THD even VL23	UINT 16	
312853	3234h	1	THD even VL31	UINT 16	
312854	3235h	1	THD even AL1	UINT 16	
312855	3236h	1	THD even AL2	UINT 16	
312856	3237h	1	THD even AL3	UINT 16	
312857	3238h	1	THD odd VL1-N	UINT 16	
312858	3239h	1	THD odd VL2-N	UINT 16	
312859	323Ah	1	THD odd VL3-N	UINT 16	
312860	323Bh	1	THD odd VL12	UINT 16	
312861	323Ch	1	THD odd VL23	UINT 16	
312862	323Dh	1	THD odd VL31	UINT 16	
312863	323Eh	1	THD odd AL1	UINT 16	
312864	323Fh	1	THD odd AL2	UINT 16	
312865	3240h	1	THD odd AL3	UINT 16	
312866	3241h	1	TDD AL1	UINT 16	
312867	3242h	1	TDD AL2	UINT 16	
312878	3243h	1	TDD AL3	UINT 16	

1.6.4 Reset counters

313569	3500h	1	Reset Total KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313570	3501h	1	Reset Total Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313571	3502h	1	Reset Total KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313572	3503h	1	Reset Total Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313573	3504h	1	Reset Partial KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313574	3505h	1	Reset Partial Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313575	3506h	1	Reset Partial KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313576	3507h	1	Reset Partial Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313577	3508h	1	Reset Run Hours	UINT 16	Value=1: command executed; see note (**)	X0
313578	3509h	1	Reset Tariff 1 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313579	350Ah	1	Reset Tariff 1 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313580	350Bh	1	Reset Tariff 1 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313581	350Ch	1	Reset Tariff 1 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313582	350Dh	1	Reset Tariff 2 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313583	350Eh	1	Reset Tariff 2 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313584	350Fh	1	Reset Tariff 2 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313585	3510h	1	Reset Tariff 2 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313586	3511h	1	Reset Tariff 3 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313587	3512h	1	Reset Tariff 3 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313588	3513h	1	Reset Tariff 3 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313589	3514h	1	Reset Tariff 3 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0

313590	3515h	1	Reset Tariff 4 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313591	3516h	1	Reset Tariff 4 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313592	3517h	1	Reset Tariff 4 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313593	3518h	1	Reset Tariff 4 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313594	3519h	1	Reset Tariff 5 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313595	351Ah	1	Reset Tariff 5 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313596	351Bh	1	Reset Tariff 5 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313597	351Ch	1	Reset Tariff 5 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313598	351Dh	1	Reset Tariff 6 KWh+	UINT 16	Value=1: command executed; see note (**)	X0
313599	351Eh	1	Reset Tariff 6 Kvarh+	UINT 16	Value=1: command executed; see note (**)	X0
313600	351Fh	1	Reset Tariff 6 KWh-	UINT 16	Value=1: command executed; see note (**)	X0
313601	3520h	1	Reset Tariff 6 Kvarh-	UINT 16	Value=1: command executed; see note (**)	X0
313602	3521h	1	Reset C1 (totalizer linked to input 4)	UINT 16	Value=1: command executed; see note (**)	X0
313603	3522h	1	Reset C2 (totalizer linked to input 5)	UINT 16	Value=1: command executed; see note (**)	X0
313604	3523h	1	Reset C3 (totalizer linked to input 6)	UINT 16	Value=1: command executed; see note (**)	X0

(**) In case of reset via a multiple Modbus write (Modbus function 10h) wait at least 1 second before performing any other Modbus request

1.7 Status

MODBUS: Read mode

Table 2.11-16

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
316385	4000h	1	Virtual alarms	UINT 16	Bit value: 0 = OFF Bit value: 1 = ON Bit position (LSB concept): 0: Alarm1 1: Alarm2 2: Alarm3 3: Alarm4 4: Alarm5 5: Alarm6 6: Alarm7 7: Alarm8 8: Alarm9 9: Alarm10 10: Alarm11 11: Alarm12 12 : Alarm13 13 : Alarm14 14 : Alarm15 15 : Alarm16	X0
316386	4001h	1	Output (port) status and configuration	UINT 16	Bit value: 0 = open Bit value 1 = closed (Note: only if port is not set as PULSE) Bit position (LSB concept): 0: reserved 1: reserved 2: Port1 3: Port2 4: Port3 5: Port4 6: Port5 7: Port6 --- Bit value: 0 = alarm or remote config port Bit value : 1 = pulse config port Bit position (MSB concept): 8: reserved 9: reserved 10: Port1 11: Port2 12: Port3 13: Port4 14: Port5 15: Port6	X0

316387	4002h	1	HW modules configuration	UINT 16	Bit value: 0 = module not present Bit value: 1 = module present Bit position: 0: HW_ MC485232 1: HW_ MCETH 2: HW_MATPN 3: HW_MFI6R4 4: HW_MFI6O6	X0
316388	4003h	1	Input (port) status	UINT 16	Bit value: 0 (ON) = closed Bit value: 1 (OFF) = open Bit position (LSB concept): 0: Port1 1: Port2 2: Port3 3: Port4 4: Port5 5: Port6	X0
316389	4004h	1	Output setup (port)	UINT 16	If port is linked to alarm: Bit value: 0 = NE (normally energized) Bit value: 1 = ND (normally de-energized) If port is set as pulse or remote: Bit value: 1 Bit position (LSB concept): 0: reserved 1: reserved 2: Port1 3: Port2 4: Port3 5: Port4 6: Port5 7: Port6	X0
316390	*4005h*	*1*	*Reserved*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
316391	*4006h*	*1*	*Reserved*	*UINT 16*		*X0*
316392	4007h	1	Wrong connection (installing help) status	UINT 16	Bit position: Bit 0 =1 means: Wrong voltage sequence Bit 1 =1 means: Current, Phase 1 inverted Bit 2 =1 means: Current, Phase 2 inverted Bit 3 =1 means: Current, Phase 3 inverted Bit 4 =1 means: Current, Phases 1 and 2 exchanged Bit 5 =1 means: Current, Phases 1 and 3 exchanged Bit 6 =1 means: Current, Phases 2 and 3 exchanged Bit 7 =1 means: Current, Phases 1, 2, 3 exchanged More bits can be 1. In any case a sequence of wiring modifications is needed until the wiring is correct (all bit=0)	X0
316393	4008h	1	Branch configuration (TCD) warning	UINT 16	0: none 1: inconsistency between the channel configuration and WM50 system (example: System configured 1P and channels configured with VL2 or VL3) 2: inconsistency between the BCM loads configuration and WM50 system (examples: System configured 2P and BCM load configured as 3 phase; System configured 3P and BCM load configured as 2 phase) 3: in the same load the same voltage is used more than one time (example: for a 3-phase load Channel 1 is set with Vl1, Channel 2 set with Vl2, Channel 3 set with VL1 or VL2)	X0

2 TCD channels and 2-phase/3-phase loads

2.1 Real time values

2.1.1 Voltage

2.1.1.1 Channel voltage reference (phase)

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
349409	C100h	1	Voltage reference channel 1	UINT16	1=L1 2=L2 3=L3	X0
	…	…	…	…	…	
349504	C15Fh	1	Voltage reference channel 96	UINT16	1=L1 2=L2 3=L3	X0

2.1.1.2 Line-neutral voltage values

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
351025	C750h	2	Vl1n	IEEE754		X0
351027	C752h	2	Vl2n	IEEE754		X0
351029	C754h	2	Vl3n	IEEE754		X0

2.1.2 Channels (1-phase): instantaneous values

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
349665	C200	2	Channel 1: Current [A]	IEEE754		X0
349667	C202	2	Channel 1: Active Power [W]	IEEE754		X0
349669	C204	2	Channel 1: Reactive power [var]	IEEE754		X0
349671	C206	2	Channel 1: Apparent power [VA]	IEEE754		X0
349673	C208	2	Channel 1: Power factor	IEEE754		X0
349675	C20A	2	Channel 1: THD current [%]	IEEE754		X0
349677	C20C	2	Channel 1: Active energy [Wh+]	UINT32		X0
	…	…	…	…	…	
350995	C732	2	Channel 96: Current [A]	IEEE754		X0
350997	C734	2	Channel 96: Active Power [W]	IEEE754		X0
350999	C736	2	Channel 96: Reactive power [var]	IEEE754		X0
351001	C738	2	Channel 96: Apparent power [VA]	IEEE754		X0
351003	C73A	2	Channel 96: Power factor	IEEE754		X0
351005	C73C	2	Channel 96: THD current [%]	IEEE754		X0
351007	C73E	2	Channel 96: Active energy [Wh+]	UINT32		X0

2.1.3 Loads (2-phase/3-phase): instantaneous values

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
351041	C760h	2	Load 1 (2p/3p): Voltage sys*[V]	IEEE754		X0
351043	C762h	2	Load 1 (2p/3p): Current L1 [A]	IEEE754		X0
351045	C764h	2	Load 1 (2p/3p): Current L2 [A]	IEEE754		X0
351047	C766h	2	Load 1 (2p/3p): Current L3 [A]	IEEE754	Only with phase 3 configured	X0
351049	C768h	2	Load 1 (2p/3p): Active Power [W]	IEEE754		X0
351051	C76Ah	2	Load 1 (2p/3p): Apparent power [VA]	IEEE754		X0
351053	C76Ch	2	Load 1 (2p/3p): Reactive power [var]	IEEE754		X0
351055	C76Eh	2	Load 1 (2p/3p): Power factor	IEEE754		X0

351057	C770h	2	Load 1 (2p/3p): THD current L1 [%]	IEEE754		X0
351059	C772h	2	Load 1 (2p/3p): THD current L2[%]	IEEE754		X0
351061	C774h	2	Load 1 (2p/3p): THD current L3[%]	IEEE754	Only with phase 3 configured	X0
351063	C776h	2	Load 1 (2p/3p): Active energy [Wh+]	UINT32		X0
	…	…	…	…	…	
352169	CBC8h	2	Load 48 (2p/3p): Voltage sys*[V]	IEEE754		X0
352171	CBCAh	2	Load 48 (2p/3p): Current L1 [A]	IEEE754		X0
352173	CBCCh	2	Load 48 (2p/3p): Current L2 [A]	IEEE754		X0
352175	CBCEh	2	Load 48 (2p/3p): Current L3 [A]	IEEE754	Only with phase 3 configured	X0
352177	CBD0h	2	Load 48 (2p/3p): Active Power [W]	IEEE754		X0
352179	CBD2h	2	Load 48 (2p/3p): Apparent power [VA]	IEEE754		X0
352181	CBD4h	2	Load 48 (2p/3p): Reactive power [var]	IEEE754		X0
352183	CBD6h	2	Load 48 (2p/3p): Power factor	IEEE754		X0
352185	CBD8h	2	Load 48 (2p/3p): THD current L1 [%]	IEEE754		X0
352187	CBDAh	2	Load 48 (2p/3p): THD current L2[%]	IEEE754		X0
352189	CBDCh	2	Load 48 (2p/3p): THD current L3[%]	IEEE754	Only with phase 3 configured	X0
352191	CBDEh	2	Load 48 (2p/3p): Active energy [Wh+]	UINT32		X0

*Calculated as average among the phases.

2.3 Min, max, average (DMD) values

Note: Min, max and average values are available only for the variable selected (via UCS software) for alarms and database.

2.3.1 Channels (1-phase)

2.3.1.1 Channels (1-phase): MAX

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
352225	CC00h	2	Channel 1: Timestamp MAX	UINT32	UNIX timestamp	X0
352227	CC02h	2	Channel 1: Value MAX selected variable	IEEE754		X0
352229	CC04h	2	Channel 2: Timestamp MAX	UINT32	UNIX timestamp	X0
352231	CC06h	2	Channel 2: Value MAX selected variable	IEEE754		X0
	…	…	…	…	…	
352605	CD7Ch	4	Channel 96: Timestamp MAX	UINT32	UNIX timestamp	X0
352607	CD7Eh	4	Channel 96: Value MAX selected variable	IEEE754		X0

2.3.1.1 Channels (1-phase): MIN

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
352609	CD80h	2	Channel 1: Timestamp MIN	UINT32	UNIX timestamp	X0
352611	CD82h	2	Channel 1: Value MIN selected variable	IEEE754		X0
352613	CD84h	2	Channel 2: Timestamp MIN	UINT32	UNIX timestamp	X0
352615	CD86h	2	Channel 2: Value MIN selected variable	IEEE754		X0
	…	…	…	…	…	
352989	CEFCh	2	Channel 96: Timestamp MIN	UINT32	UNIX timestamp	X0
352991	CEFEh	2	Channel 96: Value MIN selected variable	IEEE754		X0

2.3.1.2 Channels (1-phase): average (DMD)

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
652993	CF00h	2	Channel 1: Timestamp DMD	UINT32	UNIX timestamp	X0
652995	CF02h	2	Channel 1: Value DMD selected variable	IEEE754		X0
652997	CF04h	2	Channel 2: Timestamp DMD	UINT32	UNIX timestamp	X0
652999	CF06h	2	Channel 2: Value DMD selected variable	IEEE754		X0
	…	…	…	…	…	
353183	CFBEh	2	Channel 96: Timestamp DMD	UINT32	UNIX timestamp	X0
353185	CFC0h	2	Channel 96: Value DMD selected	IEEE754		X0

2.3.2 Loads (2-phase/3-phase)

2.3.2.1 Loads (2-phase/3-phase): MAX

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
353505	D100h	2	Load 1 (2p/3p) : Timestamp MAX	UINT32	UNIX timestamp	X0
353507	D102h	2	Load 1 (2p/3p) : Value MAX selected variable	IEEE754		X0
353509	D104h	2	Load 2 (2p/3p) : Timestamp MAX	UINT32	UNIX timestamp	X0

353511	D106h	2	Load 2 (2p/3p) : Value MAX selected variable	IEEE754		X0
	...	...	...	...	...	
353693	D1BCh	2	Load 48 (2p/3p) : Timestamp MAX	UINT32	UNIX timestamp	X0
353695	D1BEh	2	Load 48 (2p/3p) : Value MAX selected variable	IEEE754		X0

2.3.2.2 Loads (2-phase/3-phase): MIN

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
353761	D200h	2	Load 1 (2p/3p) : Timestamp MIN	UINT32	UNIX timestamp	X0
353763	D202h	2	Load 1 (2p/3p) : Value MIN selected variable	IEEE754		X0
353765	D204h	2	Load 2 (2p/3p) : Timestamp MIN	UINT32	UNIX timestamp	X0
353767	D206h	2	Load 2 (2p/3p) : Value MIN selected variable	IEEE754		X0
	...	...	...	...	...	
353949	D2Bch	2	Load 48 (2p/3p) : Timestamp MIN	UINT32	UNIX timestamp	X0
353951	D2BEh	2	Load 48 (2p/3p) : Value MIN selected variable	IEEE754		X0

2.3.2.3 Loads (2-phase/3-phase): average (DMD)

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
354017	D300h	2	Load 1 (2p/3p) : Timestamp DMD	UINT32	UNIX timestamp	X0
354019	D302h	2	Load 1 (2p/3p) : Value DMD selected variable	IEEE754		X0
354021	D304h	2	Load 2 (2p/3p) : Timestamp DMD	UINT32	UNIX timestamp	X0
354023	D306h	2	Load 2 (2p/3p) : Value DMD selected variable	IEEE754		X0
	...	...	...	...	...	
354111	D35Eh	2	Load 48 (2p/3p) : Timestamp DMD	UINT32	UNIX timestamp	X0
354113	D360h	2	Load 48 (2p/3p) : Value DMD selected variable	IEEE754		X0

2.4 Configurable modbus MAP

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
354785	D600h	2	Value of variable configured by UCS software for address D600h	Wh+: UINT32, other: IEEE754		X0
	...	...	...	....		
355283	D7F2h	2	Value of variable configured by UCS software for address D7F2h	Wh+: UINT32, other: IEEE754		X0

Note
* Data format depends on the selected variable

2.6 Alarm status

Modbus functions : 0x03,0x04

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
354593	D540h	1	Alarm channel from 1 to 16	UINT16	Bit 0 = Channel 1, Bit1 = Channel 2…etc.	X0
354594	D541h	1	Alarm channel from 17 to 32	UINT16	Bit 0 = Channel 17, Bit1 = Channel 18…etc.	X0
354595	D542h	1	Alarm channel from 33 to 48	UINT16	Bit 0 = Channel 33, Bit1 = Channel 34…etc.	X0
354596	D543h	1	Alarm channel from 49 to 64	UINT16	Bit 0 = Channel 49, Bit1 = Channel 50…etc.	X0
354597	D544h	1	Alarm channel from 65 to 80	UINT16	Bit 0 = Channel 65, Bit1 = Channel 66…etc.	X0
354598	D545h	1	Alarm channel from 81 to 96	UINT16	Bit 0 = Channel 81, Bit1 = Channel 82…etc.	X0
354599	D546h	1	Alarm load 2P/3P from 1 to 16	UINT16	Bit 0 = Load 1, Bit1 = Load 2…etc.	X0
354600	D547h	1	Alarm load 2P/3P from 17 to 32	UINT16	Bit 0 = Load 17, Bit1 = Load18…etc.	X0
354601	D548h	1	Alarm load 2P from 33 to 48	UINT16	Bit 0 = Load 33, Bit1 = Load34…etc.	X0

2.7 Commands

2.7.1 Reset commands Channels (1-phase)

Modbus functions : 0x06, 0x10
This command permits to reset the counter of every channel or the current daily max or the current daily min.

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
357601	E100h	1	Reset command for channel 1	UINT16	1 = reset counter Wh+ 2= reset daily min 3= reset daily max	X0
357602	E101h	1	Reset command for channel 2	UINT16	1 = reset counter Wh+ 2= reset daily min 3= reset daily max	X0
	…		…		…	
357696	E15Fh	1	Reset command for channel 96	UINT16	1 = reset counter Wh+ 2= reset daily min 3= reset daily max	X0

2.7.2 Reset commands loads (2-phase/3-phase)

Modbus functions : 0x06, 0x10
This command permits to reset the counter of every channel or the current daily max or the current daily min.

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
357697	E160h	1	Reset command for load (2p/3p) 1	UINT16	1 = no operation 2= reset daily min 3= reset daily max	X0
357698	E161h	1	Reset command for load (2p/3p) 2	UINT16	1 = no operation 2= reset daily min 3= reset daily max	
	…					
357744	E18Fh	1	Reset command for load 48	UINT16	1 = no operation 2= reset daily min 3= reset daily max	

2.7.3 Global Reset commands

Modbus functions : 0x06,0x10

Permitted value 1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
358113	E300h	1	Reset all max and min channels and loads	UNIT16		X0

2.7.4 Alarm reset commands

Modbus functions : 0x06, 0x10

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	FW compatibility
358129	E310h	1	Reset all latch status of channel alarms	UINT 16	Value=1: command executed Value≠1: no effect NOTE: Each alarm in latch status, but with the linked variable out of the alarm condition, is reset.	X0
358130	E311h	1	Reset all latch status of load alarms	UINT16	Value=1: command executed Value≠1: no effect NOTE: Each alarm in latch status, but with the linked variable out of the alarm condition, is reset.	X0

3 FW version and serial number

Firmware version

MODBUS: read only mode (with functions code 03 and 04) Table 2.1-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300001	0000h	1	Base firmware version	UINT 16	MSB: ASCII code for model (A=WM50AV5) LSB: numeric number for revision	X0
300002	0001h	1	Communication module firmware version (only in case MCETH module)	UINT 16	MSB: ASCII code for model LSB: numeric number for revision	X0
300003	*0002h*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
300004	0003h	1	Advanced six channel digital inputs + four channel outputs module firmware version (only in case MFI6R4 or MFI6O6)	UINT 16	MSB: ASCII code for model (A= MFI6R4, B= MFI6O6) LSB: numeric number for revision	X0
300005	0004h	1	Process module (only in case MATPN)	UINT 16	MSB: ASCII code for model (B= MATPN) LSB: numeric number for revision	X0
300006	*0005h*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*
300007	*0006h*	*1*	*RESERVED*	*UINT 16*	*Always readable as 0xFFFF*	*X0*

NOTE 1. In the following document the firmware letter “X” indicates all versions: “A” and “B” for WM50. The number indicates the firmware revision. If module is not present the reading is 0x0000.

3.1 Identification code

MODBUS: read only mode (with functions code 03 and 04) Table 2.2-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300012	000Bh	1	Carlo Gavazzi Controls identification code	UINT 16	Value = 0x0063 (99d)	X0

3.2 Serial number

MODBUS: read only mode (with functions code 03 and 04) Table 2.3-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility
300033	0020h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300034	0021h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300035	0022h	1	Letter 5 (from SX) Letter 6 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300036	0023h	1	Letter 7 (from SX) Letter 8 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300037	0024h	1	Letter 9 (from SX) Letter 10 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300038	0025h	1	Letter 11 (from SX) Letter 12 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	X0
300039	0026h	1	Letter 13 (from SX)	UINT 16	MSB: ASCII code	X0

4 APPENDIX: COMMUNICATION PROTOCOL

4.1 Introduction

For a complete description of the MODBUS protocol refer to "Modbus_Application_Protocol_V1_1a.pdf" and "Modbus_Messaging_Implementation_Guide_V1_0a.pdf" documents that can be download from the www.modbus.org web site.

4.2 MODBUS functions

These functions are available on WM50 Base:

1. Reading of n "Holding Registers" (code 03h)
2. Reading of n "Input Register" (code 04h)
3. Writing of one "Holding Registers" (code 06h)
4. Writing of multiple register (code 10h)
5. Diagnostic (code 08h with sub-function code 00h)
6. Broadcast mode (writing instruction on address 00h)

IMPORTANT:

1. In this document the "Modbus address" field is indicated in two ways:
   a. "**Modicom address**": it is the "6 digit Modicom" representation with the Modbus function code 04 (Read Input Registers). It is possible to read the same values with the function code 03 (Read Holding Register) substituting the first digit with number "4".
2. "**Physical address**": it is the "word address" value included in the communication frame.
3. The functions 03h and 04h have exactly the same effect.
4. The communication parameters must be set according to the configuration of the instrument (refer to the WM50 instruction manual)

4.2.1 Function 03h (Read holding registers)

This function code is used to read the contents of a contiguous block of holding registers (word). The request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 125 registers (word) with a single request.
The register data in the response message are packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	03h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (**N** word)	2 bytes	1 to 7Dh (1 to 125)	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	03h	
Byte count	1 byte	**N** word * 2	
Register value	**N***2 bytes		Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	83h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

4.2.2 Function 04h (Read input registers)

This function code is used to read the contents of a contiguous block of input registers (word). The request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 125 registers (word) with a single request.
The register data in the response message are packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	04h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (**N** word)	2 bytes	1 to 7Dh (1 to 125)	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	04h	
Byte count	1 byte	**N** word * 2	
Register value	**N***2 bytes		Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	84h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

4.2.3 Function 06h (Write single holding register)

This function code is used to write a single holding register. The request frame specifies the address of the register (word) to be written and its content.
The correct response is an echo of the request, returned after the register contents have been written.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	06h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	06h	
Starting Address	2 bytes	0000h to FFFFh	
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	86h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

4.2.4 Function 10h (Write multiple register)

This function code is used to write a block of contiguous registers (maximum 123). The requested values to be written are specified in the request data field. Data is packed as two bytes per register.
The correct response returns the function code, starting address, and the quantity of written registers.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (**N** word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
Byte count	1 byte	**N** word * 2	
Register value	**N** * 2 bytes	value	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (**N** word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	90h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

4.2.5 Function 08h (Diagnostic with sub-function code 00h)

The MODBUS function code 08h provides a series of tests to check the communication system between a client (Master) device and a server (Slave), or to check various internal error conditions within a server. WM50 supports only 0000h sub-function code (Return Query Data). With this sub-function the data passed in the request data field is to be returned (looped back) in the response. The entire response message should be identical to the request.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	
Data (**N** word)	2 bytes	**N** word * 2	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	
Data (**N** word)	2 bytes	**N** word * 2	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 247)	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	88h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

4.2.6 Broadcast mode

In broadcast mode the master can send a request (command) to the all slaves. No response is returned to broadcast requests sent by the master. It is possible to send the broadcast message only with the function code 06h and 10h and using the address 00h.

4.3 Application notes

4.3.1 General consideration

1. To avoid errors due to the signal reflections or line coupling, it is necessary to terminate the input of the last instrument on the network, and also the reception of the Host. The termination on both the instrument and the host is necessary even in case of point-to-point connection, within short distances.
2. The GND connection is optional if a shielded cable is used.
3. For connections longer than 1000 m, a line amplifier is necessary.
4. If an instrument does not answer within the “max answering time”, it is necessary to repeat the query. If the instrument does not answer after 2 or 3 consecutive queries, it must be considered as not connected, faulty or with wrong address. The same consideration is valid in case of CRC errors or incomplete frames.

4.3.2 MODBUS timing

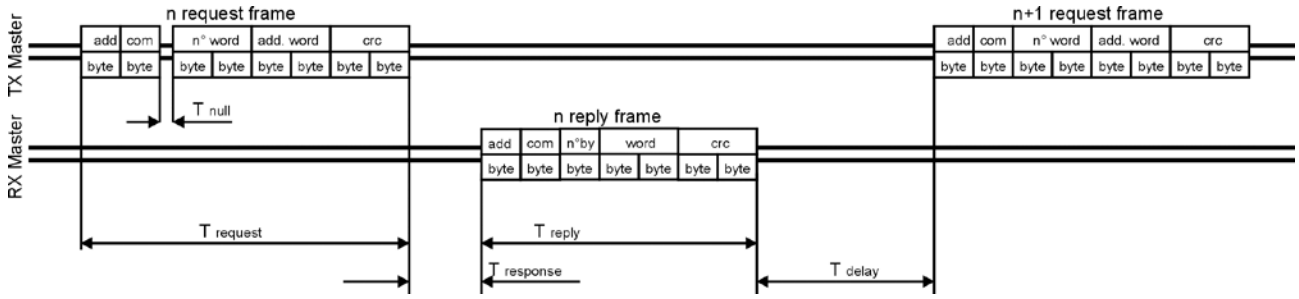


Fig. 1 : 4-wire timing diagram

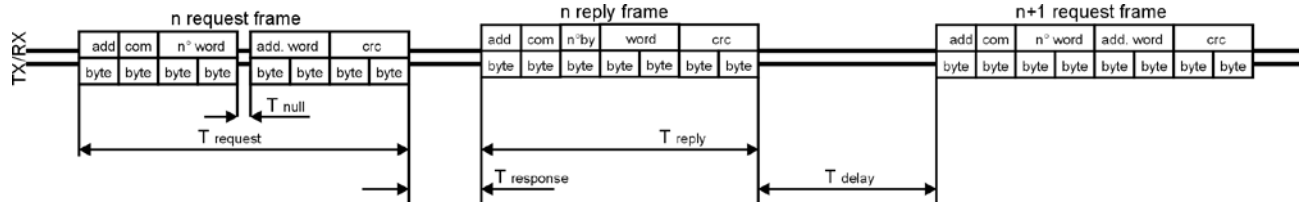


Fig. 2 : 2-wire timing diagram

Timing characteristics of reading function:	msec
T response: Max answering time	1000 ms
T response: Typical answering time @9600 bps	<10 ms
T response: Typical answering time @115200 bps	<10 ms
T delay: Minimum time for a new query	9600 baud-rate: 3,5 char 19200 baud-rate: 3,5 char 38400 baud-rate: 1,75 ms 115200 baud-rate: 1,75 ms
T null: Max interruption time on the request frame	9600 baud-rate: 2,5 char 19200 baud-rate: 2,5 char 38400 baud-rate: 1,75 ms 115200 baud-rate: 1,75 ms

Where: n char = n*10/baud rate

4.4 Data format representation in Carlo Gavazzi instruments

The variables are represented by integers or floating numbers, with 2's complement notation in case of "signed" format, using the following:

Format	IEC data type	Description	Bits	Range
INT16	INT	Integer	16	-32768 .. 32767
UINT16	UINT	Unsigned integer	16	0 .. 65535
INT32	DINT	Double integer	32	-2^{31} .. 2^{31}
UINT32	UDINT	Unsigned double int	32	0 .. 2^{32}-1
UINT64	ULINT	Unsigned long integer	64	0 .. 2^{64}-1
IEEE754 SP		Single-precision floating-point	32	$-(1+[1-2^{-23}])x2^{127}$ .. 2^{128}

The IEEE754 representation of a 32-bit floating-point number as an integer is defined as follows:

32-bit floating-point

Bits		
31	30 … 23	22 … 0
Sign	Exponent	Mantissa

$$(-1)^{sign} * 2^{(Exponent-127)} * 1.Mantissa$$

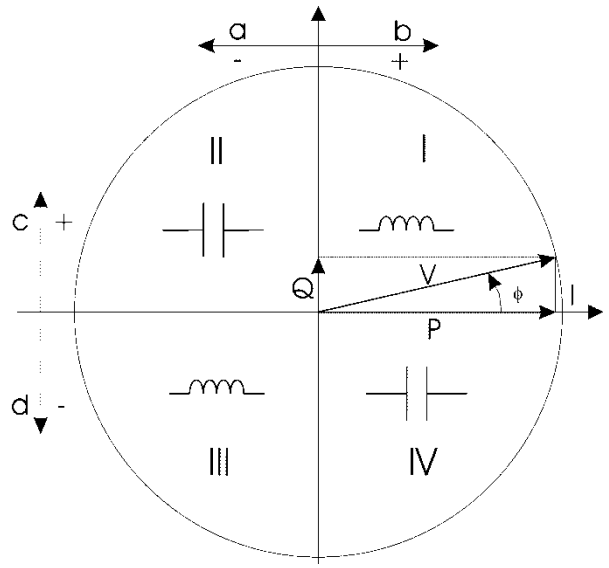
The byte order in the MODBUS (and ANSI) frame is:

1st byte = Bits 15 … 8 of the 32-bit floating-point number in standard IEEE-754
2nd byte = Bits 7 … 0 of the 32-bit floating-point number in standard IEEE-754
3rd byte = Bits 31 … 24 of the 32-bit floating-point number in standard IEEE-754
4th byte = Bits 23 … 16 of the 32-bit floating-point number in standard IEEE-754

The integers are represented in UINT16 (16 bit) or UINT64 (64 bit) format without sign (the byte order inside the single word is MSB->LSB while the word order is LSW->MSW).

4.4.1 Geometric representation

According to the signs of the power factor, the active power P and the reactive power Q, it is possible to obtain a geometric representation of the power vector, as indicated in the drawing below, according to EN 62053:



a = Exported active power
b = Imported active power
c = Imported reactive power
d = Exported reactive power

Fig. 3 : Geometric Representation