Codice progetto/prodotto:

FM574 – FM587 – FM589

Descrizione:

Protocollo Comunicazione ModBus

Tipo di documento:

Descrizione Tabella dei Registri

Versioni di riferimento:

FM574v3xx – FM574v32x

F M587v3xx – FM587v4xx

FM589v3xx – FM589v4xx

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Indice

Protocollo ModBus

L'azionamento è dotato di una porta RS232 utilizzata per la configurazione dell'azionamento ed il controllo remoto.

La comunicazione seriale è basata sul protocollo standard ModBus in modalità RTU (per informazioni consultare il sito www.modbus.org). Sono supportate solo alcune delle funzioni standard:

1. il buffer di ricezione/trasmissione è di soli 50bytes, questo limita il numero di registri trasferibili in un'unica transazione ModBus, si consiglia non più di 10.
2. sono riconosciute solo le seguenti funzioni standard:

Codice Funzione	Nome Funzione
03h	Read Holding Registers
04h	Read Input Registers
06h	Write Single Register
10h	Write Multiple Register

3. sono definite alcune funzioni speciali:

Cod.Funzione	Nome
41h	Richiesta di trasmissione del record di identificazione apparecchiatura. Riporta codici e numeri di versione di hardware e software.

Le impostazioni di comunicazione sono:

Baudrate	19200bps
Byte	8bit
Parità	Pari
Stop	1bit

Nota: Ogni registro trasporta un parametro delle dimensioni di 2bytes, secondo le indicazioni dello standard ModBus. Il trasporto di parametri di tipo "long" è ottenuto sfruttando due registri contigui con trasmissione in ordine Lo-Hi.

Attenzione: È a disposizione un software che consente l'accesso facilitato a tutte le opzioni ed i parametri, di grande aiuto nella fase di installazione. Si raccomanda l'utilizzo dello stesso in quanto contiene funzioni di validazione dei valori introdotti che minimizzano possibili errori.

Nota sulle unità di misura

Unità	Descrizione
Frac16	Rappresentazione in virgola fissa di un numero frazionario compreso tra -1.0 e +1.0, corrispondente a -32768 e 32767. reg = value * 32768 value = reg / 32768
Base 2 Exp.	Termine esponenziale in base 2 di un numero composto da una mantissa Frac16: Frac16 * 2^{exp}
stp	Numero di step elementari del motore. Su un singolo giro il motore compie 65536 passi elementari.
[unit] .../10 .../100	Ogni unità del registro corrisponde a 1/10 o 1/100 etc... dell'unità di misura indicata. V/10 = decimi di Volt s/100 = centesimi di Secondo
bit-field	Significa che il contenuto del registro assume significato bit per bit.
CanStdID	Si tratta di un indirizzo CAN standard, identificatore a 11bit.
non specificato	Significa che si tratta di numeri puri. • conteggio di elementi • indici predefiniti • fattori di rapporti numerici

ModBus Registers Table (Data Model)

Drive setup:

I registri sopraelencati raccolgono i parametri fondamentali per la configurazione dell'azionamento.

I registri sono allocati in RAM quindi si tratta di impostazioni immediatamente recepite ma volatili. Ad ogni registro volatile elencato corrisponde un registro permanente allocato in EEPROM con indirizzo pari a quello del registro volatile +200 (il cui valore viene caricato solo in fase di start-up).

Esempio: il registro 201 conterrà la versione permanente del parametro “Main supply voltage”.

Reg.	Unit	Description		Device					
				FM574 3.xx	FM574 3.2x	FM587 3.xx	FM587 4.xx	FM589 3.xx	FM589 4.xx
1	V/10	Main supply voltage		O	O				
2	bit-field	Configuration flags	Vedi Tabella Dettagli	O	O	O	O	O	O
3	ms	Brake OFF delay		O	O			O	O
4	ms	Brake ON delay		O	O			O	O
5	Frac16	Analog reference offset		O	O			O	O
6	Frac16	Armature offset						O	O
9	ohm/10	RxI Compensation						O	O
10		Type of motor	0="PMSM (sin-brushless)" 1="BLDC (dc-brushless)" 2="ACIM (asynchronous)" 3="DCM (brush-dc motor)"	O	O			O	O
11	V/10	Nominal rms phase voltage		O	O			O	O
12	A/10	Nominal rms phase current		O	O			O	O
12	A/10	Holding phase current				O	O		
13	A/10	Maximum rms phase current		O	O			O	O
13	A/10	Peak phase current				O	O		
14	A/10	Magnetizing current		O	O			O	O
15	rpm	Nominal speed		O	O			O	O
16	rpm	Maximum speed		O	O	O	O	O	O
17		Motor poles number		O	O			O	O
17		Motor step/revolution				O	O		
18	Lr/Rr Frac16 * s	Motor time constant		O	O			O	O
19	s	Max current timeout		O	O			O	O
19	s/1000	Holding current delay				O	O		
20	pulse/rev	Main encoder pulse/rev.		O	O	O	O	O	O
21	bit-field	Main encoder options	bit0=Reverse encoder	O	O	O	O	O	O
22	pulse/rev	Secondary encoder pulse/rev.		O	O				
23	bit-field	Secondary encoder options	bit0=Reverse encoder	O	O				
24	bit-field	Hall-Effect options	Vedi Tabella Dettagli	O	O			O	O
25		Resolver poles number		O	O			O	O
26	bit-field	Resolver options	bit0=Reverse resolver	O	O			O	O
27	stp	Field alignement offset		O	O			O	O

Reg.	Unit	Description		Device					
				FM574 3.xx	FM574 3.2x	FM587 3.xx	FM587 4.xx	FM589 3.xx	FM589 4.xx
30		Ramp generator input	0=Zero 1=Primary digital 2=Analog input 3=Internal value 4=Loop ramp output 5=Position controller output 6=Speed feedback	**O**	**O**	**O**	**O**	**O**	**O**
31		Position displacement source	0=Resolver 1=Main Encoder 2=Secondary Encoder 3=Hall-Effect 4=Stepping motor position 5=Analog input 6=External position index	**O**	**O**	**O**	**O**	**O**	**O**
32		Position target source	0=Positioning profile 1=Internal position index 2=Position feedback	**O**	**O**	**O**	**O**	**O**	**O**
33		Position feedback source	0=Resolver 1=Main Encoder 2=Secondary Encoder 3=Hall-Effect 4=Stepping motor position 5=Analog input	**O**	**O**	**O**	**O**	**O**	**O**
34		Speed reference source	0=Zero 1=Primary digital 2=Analog input 3=Internal speed index 4=Ramp generator 5=Position controller output 6=Speed feedback 7=Resolver 8=Main Encoder 9=Secondary Encoder 10=Hall-Effect	**O**	**O**	**O**	**O**	**O**	**O**
35		Speed feedback source	0=Resolver 1=Main Encoder 2=Secondary Encoder 3=Hall-Effect 4=Stepping motor position 5=Analog input 6=Armature feedback	**O**	**O**	**O**	**O**	**O**	**O**
36		Current reference source	0=Zero 1=Primary digital 2=Analog input 3=Speed controller output	**O**	**O**			**O**	**O**
37		Current limit source	0=Zero 1=Secondary digital 2=Analog input 3=Peak current limit 4=I2T current limit	**O**	**O**			**O**	**O**
38		Phase generation source	0=Resolver 1=Main Encoder 2=Hall-Effect	**O**	**O**			**O**	**O**
40	Frac16	Zero speed max		**O**	**O**	**O**	**O**	**O**	**O**

Reg.	Unit	Description	Device					
			FM574 3.xx	FM574 3.2x	FM587 3.xx	FM587 4.xx	FM589 3.xx	FM589 4.xx
41	Frac16	Zero speed min	O	O	O	O	O	O
42		Zero timeout	O	O	O	O	O	O
43-44 (Lo-Hi long)	stp	Max position limit	O	O	O	O	O	O
45-46 (Lo-Hi long)	stp	Min position limit	O	O	O	O	O	O
47		Elect Axis Gear numerator	O	O	O	O	O	O
48		Elect Axis Gear denominator	O	O	O	O	O	O
50	s/100	Acceleretion ramp time	O	O	O	O	O	O
51	s/100	Deceleration ramp time	O	O	O	O	O	O
52	s/100	Positioning acceleration	O	O	O	O	O	O
53	s/100	Positioning deceleration	O	O	O	O	O	O
54	Frac16	Positioning speed	O	O	O	O	O	O
55-56 (Lo-Hi long)	stp	Positioning target	O	O	O	O	O	O
62	Frac16	Elect Axis P Gain	O	O	O	O	O	O
63	Frac16	Elect Axis I Gain	O	O	O	O	O	O
64	Frac16	Elect Axis D Gain	O	O	O	O	O	O
65	Base 2 Exp.	Elect Axis P Scale	O		O	O	O	
65	Frac16	Elect Axis I Correction		O				O
66	Base 2 Exp.	Elect Axis I Scale	O		O	O	O	
67	Base 2 Exp.	Elect Axis D Scale	O		O	O	O	
68	Frac16	Elect Axis Feed-Forward gain	O	O	O	O	O	O
69	Base 2 Exp.	Elect Axis Feed-Forward scale	O	O	O	O	O	O
70	Frac16	Field loop P Gain	O	O			O	O
71	Frac16	Field loop I Gain	O	O			O	O
72	Base 2 Exp.	Field loop P scale	O				O	
72	Frac16	Field loop I Correction		O				O
73	Base 2 Exp.	Field loop I scale	O				O	
74	stp	Positioning window	O	O	O	O	O	O
75	Frac16	Position loop P Gain	O	O	O	O	O	O
76	Frac16	Position loop I Gain	O	O	O	O	O	O
77	Frac16	Position loop D Gain	O	O	O	O	O	O
78	Base 2 Exp.	Position loop P scale	O		O	O	O	
78	Frac16	Position loop I Correction		O				O
79	Base 2 Exp.	Position loop I scale	O		O	O	O	
80	Base 2 Exp.	Position loop D scale	O		O	O	O	
81	Frac16	Position Feed-Forward gain	O		O	O	O	
82	Base 2 Exp.	Position Feed-Forward scale	O		O	O	O	
83	Frac16	Zero speed window	O	O	O	O	O	O
84	Frac16	Speed loop P Gain	O	O			O	O
85	Frac16	Speed loop I Gain	O	O			O	O
86	Base 2 Exp.	Speed loop P scale	O				O	
86	Frac16	Speed loop I Correction		O				O
87	Base 2 Exp.	Speed loop I scale	O				O	
88	Frac16	Speed Feed-Forward Gain	O	O			O	O
89	Frac16	SQ current loop P Gain	O	O			O	O

Reg.	Unit	Description		Device					
				FM574 3.xx	FM574 3.2x	FM587 3.xx	FM587 4.xx	FM589 3.xx	FM589 4.xx
90	Frac16	SQ current loop I Gain		**O**	**O**			**O**	**O**
91	Base 2 Exp.	SQ current loop P scale		**O**				**O**	
91	Frac16	SQ current loop I Correction			**O**				**O**
92	Base 2 Exp.	SQ current loop I scale		**O**				**O**	
93	Frac16	SD current loop P Gain		**O**	**O**			**O**	**O**
94	Frac16	SD current loop I Gain		**O**	**O**			**O**	**O**
95	Base 2 Exp.	SD current loop P scale		**O**				**O**	
95	Frac16	SD current loop I Correction			**O**				**O**
96	Base 2 Exp.	SD current loop I scale		**O**				**O**	
99		Next predefined position		**O**	**O**				
100	bit-field	Option flags	Vedi Tabella Dettagli	**O**	**O**	**O**	**O**	**O**	**O**
110		ModBus Baudrate	0=600bps 1=1200bps 2=2400bps 3=4800bps 4=7200bps 5=9600bps 6=14400bps 7=19200bps 8=28800bps 9=38400bps 10=57600bps 11=76800bps 12=115200bps 13=230400bps	**O**	**O**	**O**	**O**		
111		ModBus Address		**O**	**O**	**O**	**O**		
112		Microstep Number				**O**	**O**		
118	CanStdID	Standard Rx CAN ID address, standard ID operation only					**O**		**O**
119	CanStdID	Standard Tx CAN ID address, standard ID operation only					**O**		**O**
120		CAN-Bus baudrate setup	0=10Kbps 1=20Kbps 2=50Kbps 3=125Kbps 4=250Kbps 5=500Kbps 6=800Kbps 7=1Mbps	**O**	**O**	**O**	**8=333K bps**	**O**	**8=333K bps**
121		CAN-Bus slave address identifier		**O**	**O**	**O**	**O**	**O**	**O**
122		1] Reg. cycle write	Registri che compongono il pacchetto CAN ciclico in scrittura.	**O**	**O**	**O**	**O**	**O**	**O**
123		2] Reg. cycle write		**O**	**O**	**O**	**O**	**O**	**O**
124		3] Reg. cycle write		**O**	**O**	**O**	**O**	**O**	**O**
125		4] Reg. cycle write		**O**	**O**	**O**	**O**	**O**	**O**
126		1] Reg. cycle read	Registri che compongono il pacchetto CAN ciclico in lettura.	**O**	**O**	**O**	**O**	**O**	**O**
127		2] Reg. cycle read		**O**	**O**	**O**	**O**	**O**	**O**
128		3] Reg. cycle read		**O**	**O**	**O**	**O**	**O**	**O**
129		4] Reg. cycle read		**O**	**O**	**O**	**O**	**O**	**O**
149		Predefined positions number		**O**	**O**				

Commands:

I registri che seguono consentono di comandare tramite comunicazione seriale l'azionamento.

Reg.	Unit	Description		Device		
				FM574 3.xx / 3.2x	FM587 3.xx / 4.xx	FM589 3.xx / 4.xx
101	bit-field	Drive commands	bit0=Reset position bit1=Find zero... (HomeSwitch) bit2=Set forced position bit4=Synchronization signal bit15=Make Field Alignement / Armature Offset	**O**	**O**	**O**
102	bit-field	Remote virtual input	bit0=Enable drive bit1=Reset alarms	**O**	**O**	**O**
103	Frac16	Primary digital reference		**O**	**O**	**O**
104	Frac16	Secondary digital reference		**O**	**O**	**O**
105-106 (Lo-Hi long)	stp	Elect axis position index		**O**	**O**	**O**
107	stp/ms	Elect axis speed index		**O**	**O**	**O**
108-109 (Lo-Hi long)	stp	Force Actual Position		**O**	**O**	**O**

Position preset:

Esiste la possibilità di definire un preset di posizioni o di movimenti, fino a 10, da poter richiamare al volo semplicemente assegnando l'opportuno valore ai registri 99 e 149.

Reg.	Unit	Description	Device		
			FM574 3.xx / 3.2x	FM587 3.xx / 4.xx	FM589 3.xx / 4.xx
150	s/100	Positioning Acceleration	**O**		
151	s/100	Positioning Deceleration	**O**		
152	Frac16	Positioning Speed	**O**		
153-154 (Lo-Hi long)	stp	Positioning Target	**O**		
155	s/100	Positioning Acceleration	**O**		
156	s/100	Positioning Deceleration	**O**		
157	Frac16	Positioning Speed	**O**		
158-159 (Lo-Hi long)	stp	Positioning Target	**O**		
160	s/100	Positioning Acceleration	**O**		
161	s/100	Positioning Deceleration	**O**		
162	Frac16	Positioning Speed	**O**		
163-164 (Lo-Hi long)	stp	Positioning Target	**O**		
165	s/100	Positioning Acceleration	**O**		
166	s/100	Positioning Deceleration	**O**		
167	Frac16	Positioning Speed	**O**		
168-169 (Lo-Hi long)	stp	Positioning Target	**O**		
170	s/100	Positioning Acceleration	**O**		
171	s/100	Positioning Deceleration	**O**		
172	Frac16	Positioning Speed	**O**		
173-174 (Lo-Hi long)	stp	Positioning Target	**O**		
175	s/100	Positioning Acceleration	**O**		
176	s/100	Positioning Deceleration	**O**		
177	Frac16	Positioning Speed	**O**		
178-179 (Lo-Hi long)	stp	Positioning Target	**O**		
180	s/100	Positioning Acceleration	**O**		
181	s/100	Positioning Deceleration	**O**		
182	Frac16	Positioning Speed	**O**		
183-184 (Lo-Hi long)	stp	Positioning Target	**O**		
185	s/100	Positioning Acceleration	**O**		
186	s/100	Positioning Deceleration	**O**		
187	Frac16	Positioning Speed	**O**		
188-189 (Lo-Hi long)	stp	Positioning Target	**O**		
190	s/100	Positioning Acceleration	**O**		
191	s/100	Positioning Deceleration	**O**		
192	Frac16	Positioning Speed	**O**		

Reg.	Unit	Description	Device		
			FM574 3.xx / 3.2x	FM587 3.xx / 4.xx	FM589 3.xx / 4.xx
193-194 (Lo-Hi long)	stp	Positioning Target	**O**		
195	s/100	Positioning Acceleration	**O**		
196	s/100	Positioning Deceleration	**O**		
197	Frac16	Positioning Speed	**O**		
198-199 (Lo-Hi long)	stp	Positioning Target	**O**		

State and Alarms:

Sono registri in sola lettura che forniscono una rappresentazione dello stato di funzionamento.

Reg.	Unit	Description		Device		
				FM574 3.xx / 3.2x	FM587 3.xx / 4.xx	FM589 3.xx / 4.xx
400	V/10	Supply voltage limit		**O**	**O**	**O**
401	A/10	Maximum continuous current		**O**	**O**	**O**
402	A/10	Hardware current limit		**O**	**O**	**O**
403	bit-field	Hardware input	bit0=DriveEnable bit1=HomeSwitch bit2=CwSwitch bit3=CcwSwitch	**O**	**O**	**O**
404	Frac16	Analog reference		**O**		**O**
405	V/10	DC-Bus voltage		**O**	**O**	**O**
406	Hz/10	Output frequency		**O**		**O**
407	V/10	Output voltage		**O**		**O**
408	A/10	Current value		**O**	**O**	**O**
409	rpm	Motor speed		**O**	**O**	**O**
410	bit-field	Control loop state	bit0=Speed reached bit1=End profile bit2=Position reached bit3=Stopped (speed is zero)	**O**	**O**	**O**
411	V/10	Armature voltage				**O**
420-421 (Lo-Hi long)	stp	Actual position		**O**	**O**	**O**
440	bit-field	Previous Fault	Vedi Tabella Dettagli	**O**	**O**	**O**
441	bit-field	Previous Warning		**O**	**O**	**O**
442	bit-field	Actual Fault		**O**	**O**	**O**
443	bit-field	Actual Warning		**O**	**O**	**O**

Tabelle dettagli registri

Reg.2				
FM574 3.xx / 3.2x	**FM587 3.xx**	**FM587 4.xx**	**FM589 3.xx**	**FM589 4.xx**
bit0=Enable source 0=From hardware input 1=Command from field-bus				
bit1=Temperature sense 0=Without temp. sensor 1=With temp. sensor	bit1=Stepping source 0=From hardware input 1=Command from field-bus			
bit2=Software limits 0=Disabled 1=Enabled				
bit3=Hardware limits 0=Disabled 1=Enabled			bit3=Hardware limits 0=Disabled 1=Enabled	
bit4=Zeroing active level 0=Active Low 1=Active High				
bit5=Zeroing direction 0=--Inactive-|0|---Active--> 1=--Active---|0|-Inactive-->				
bit6=Output relay 0=Mechanical brake 1=Alarm signal				
		bit11=CAN protocol type select 0=Extend addr. operation (dflt) 1=Standard addr. operation		bit11=CAN protocol type select 0=Extend addr. operation (dflt) 1=Standard addr. operation
bit12=Communitation timeout 0=Enabled 1=Disabled				
bit13=Deceleration behavior 0=Four Quadrants (generator) 1=Two Quadrants (free-wheel,only positive torque)			bit13=Deceleration behavior 0=Four Quadrants (generator) 1=Two Quadrants (free-wheel,only positive torque)	
bit14=Auto calibration 0=Auto calibrate I and V 1=No calibration			bit14=Auto calibration 0=Auto calibrate I and V 1=No calibration	

Reg.24		
FM574 **3.xx / 3.2x**	**FM587** **3.xx / 4.xx**	**FM589** **3.xx / 4.xx**
bit0=Reverse hall-effect sense bit1=Active level High (else active level i low)		bit0=Sensor sequence reverse bit1=Sensor input exchange U / W bit2=Active level High (else active level i low) bit3=Speed filtering enable bit4=BEMF commutation, zero / peak aligned bit5=Motor phase sequence U-W-V / U-V-W

Reg.100		
FM574 **3.xx / 3.2x**	**FM587** **3.xx / 4.xx**	**FM589** **3.xx / 4.xx**
bit0 – bit3=Control mode 0=Current loop 1=Speed loop 2=Electrical axis 3=Absolute positioning 4=Absolute predefined positioning 5=Relative positioning 6=Relative predefined positioning 15=User free mode bit4=Stop mode 0=Stop free wheel 1=Stop with ramp bit5=Reference synchronization 0=Auto sync. on change 1=Wait sync. Signal bit7=End switch brake 0=Current limit brake 1=Free-Wheel release bit8=Field weakening 0=Disabled 1=Enabled	bit0 – bit3=Control mode 0=Current loop 1=Speed loop 2=Electrical axis 3=Absolute positioning 4=Absolute predefined positioning 5=Relative positioning 6=Relative predefined positioning 15=User free mode bit4=Stop mode 0=Stop free wheel 1=Stop with ramp bit5=Reference synchronization 0=Auto sync. on change 1=Wait sync. Signal	bit0 – bit3=Control mode 0=Current loop 1=Speed loop 2=Electrical axis 3=Absolute positioning 4=Absolute predefined positioning 5=Relative positioning 6=Relative predefined positioning 15=User free mode bit4=Stop mode 0=Stop free wheel 1=Stop with ramp bit5=Reference synchronization 0=Auto sync. on change 1=Wait sync. Signal bit7=End switch brake 0=Current limit brake 1=Free-Wheel release bit8=Field weakening 0=Disabled 1=Enabled

Reg.440 – 442		
FM574 **3.xx / 3.2x**	**FM587** **3.xx / 4.xx**	**FM589** **3.xx / 4.xx**
bit0=Over Voltage bit1=Over Current bit2=Under Voltage bit3=Wrong Configuration bit4=Power Overheat bit5=IxT Power protect bit6=Motor Overheat bit7=I^2T Motor protect bit8=Short / Power Fault bit9=Initial position error bit10=Zeroing timeout bit11=Hall-effect disconnected bit12=Resolver loss of signal bit13=Resolver loss of tracking bit14=Communication timeout bit15=CAN-BUS error	bit0=Over Voltage bit1=Over Current bit2=Under Voltage bit3=Wrong Configuration bit4=Power Overheat bit6=Motor Overheat bit8=Short / Power Fault bit10=Zeroing timeout bit14=Communication timeout bit15=CAN-BUS error	bit0=Over Voltage bit1=Over Current bit2=Under Voltage bit3=Wrong Configuration bit4=Power Overheat bit5=IxT Power protect bit6=Motor Overheat bit7=I^2T Motor protect bit8=Short / Power Fault bit9=Initial position error bit10=Zeroing timeout bit11=Hall-effect disconnected bit14=Communication timeout bit15=CAN-BUS error

Reg.441 – 443		
FM574 **3.xx / 3.2x**	**FM587** **3.xx / 4.xx**	**FM589** **3.xx / 4.xx**
bit0=Power-Up Sequence bit1=Invalid Zeroing bit2=Max software limit bit3=Min software limit bit4=Max hardware limit bit5=Min hardware limit bit6=Resolver adjusted bit7=Resolver adjust error	bit0=Power-Up Sequence bit1=Invalid Zeroing bit2=Max software limit bit3=Min software limit bit4=Max hardware limit bit5=Min hardware limit	bit0=Power-Up Sequence bit1=Invalid Zeroing bit2=Max software limit bit3=Min software limit bit4=Max hardware limit bit5=Min hardware limit

Protocollo CAN

Sugli azionamenti in oggetto è implementato un protocollo di comunicazione su CAN-Bus. Si tratta di un protocollo proprietario, molto semplice e snello. L'accesso ai parametri è basato sulla stessa tabella di registri definita per il ModBus descritta in questo documento.

Caratteristiche e modalità di funzionamento del protocollo CAN sono descritte nel documento “FM_DRIVE_CanBus”.