Foucault Pendulum Electronics Kit.

D06_Arduino PinUse & Messages.

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Document version	2026-05-24
Relates to PCB version	PCB BobControl v1
Related Documents	Schema BobControl PCB. D07_Description_Firmware. D08_Description GUI_Software.

In brief:
The GUI is the program for display, control and datalogging running on a PC or Laptop.
The Arduino firmware controls the hardware on the PCB BobControl.
The GUI sends UDP messages to the Arduino at a 10 Hz rate. Arduino replies on each message.
The Arduino Serial_0 (USB) is only used for programming and for diagnose via the Arduino Monitor.

Table 1: Arduino MEGA Pin use

Arduino Pin	Port/bit	Function	To/From	Purpose	Remark
0, 1	PE0, PE1	RXD, TXD	USB converter	Programming Diagnose	
2	PE4-INT4	n.c.			
3	OC3C	n.c.			
4	PG5	n.c.			
5	OC3A	n.c.			
6	OC4A	DRIVE_PWM			
7	PH4	n.c.			
8	PH5	Reset	Via Delay Circuit	Reset Arduino + Hardware	
9	PH6	n.c.			
10	PB4	SEL_ETH	ETH Shield		
11 .. 13	misc	n.c.			
14	TX3	n.c.			
15	RX3	n.c.			
16	TX2	n.c.			
17	RX2	n.c.			
18	TXD1	n.c.			
19	RXD1	n.c.			
20	PD1-SDA	BME280-Top Unit			
21	PD0-SCL	BME280-Top Unit			
22	PA0	SCLK	DDS Module		
23	PA1	SDATA	DDS Module		
24	PA2	FSYNC	DDS Module		
25	PA3	n.c.			
26	PA4	n.c.			
27	PA5	n.c.			

28	PA6	n.c.			
29	PA7	n.c.			
30	PC7	LED SP2			
31	PC6	Jumper OPT 1-2			
32	PC5	LED SP1			
33	PC4	Jumper OPT 3-4			
34	PC3	LED COMM			
35	PC2	Jumper OPT 5-6			
36	PC1	LED HFSW			
37	PC0	Jumper Opt 7-8			
38	PD7	n.c.			
39	PG2	TOUCH-WIRE		e.g. Charron ring	
40	PG1	n.c.			
41	PG0	/DRV pulse			
42	PL7	LED RIM2			
43	PL6	n.c.			
44	PL5	LED RIM1			
45	PL4	C_SHORT		Short Center signal from Drive Coil	
46	PL3	LED DRV			
47	PL2	DDS-OUT	Timer 5 Clock input		~465 kHz
48	PL1	LED CENTER			
49	PL0	C_GATE		Enable Center signal from Drive coil	
50	PB3	SPI_MISO	ETH Shield		
51	PB2	SPI_MOSI	ETH Shield		
52	PB1	SPI_SCK	ETH Shield		
53	PB0	SPI_SS	ETH Shield		
AN0	PF0	PMS_North	analog in		
AN1	PF1	PMS-South	analog in		
AN2	PF2	PMS_West	analog in		
AN3	PF3	PMS_East	analog in		
AN4	PF4	Detect Center Pass C	analog in	Capacitive	
AN5	PF5	Detect Center Pass M	analog in	Magnetic	
AN6	PF6	Detect Rim Pass C	analog in	Capacitive	
AN7	PF7	Detect Rim Pass M	analog in	Magnetic	
AN8	PK0	DIAGPIN_A8		Message in / out	
AN9	PK1	DIAGPIN_A9		t.b.d.	
AN10	PK2	DIAGPIN_A10		Rim Pass Magn	
AN11	PK3	DIAGPIN_A11		Center Pass Magn	
AN12	PK4	DIAGPIN_A12		Center Pass Cap	
AN13	PK5	DIAGPIN_A13		Divider Final	
AN14	PK6	DIAGPIN_A14		Timer 5 Intr	DDS input divider

AN15	PK7	DIAGPIN_A15		handler 20 kHz Intr handler	

Table 2: Arduino MEGA Timer use

Timer	Arduino Port / Pin	Function	Remark
0, 8 bit	-	Arduino System	Dont Touch
1, 16 bit		20 kHz interrupt	Workhorse
2, 8 bit		not used	
3, 16 bit		not used	
4, 16 bit	PH3, pin 6, PWM OUT	PWM for Drive Current	
5, 16 bit	PL2, pin 47 Clock Input	Frequency Divider T5	Clocked From DDS

Table 3 Message from GUI to Arduino: Size = 40 bytes (with some margin)

Byte nr (C++). Pascal = +1	Purpose	Value, Range, meaning	Remark
0..3	Command Drive_SyncMode 0 = ByCharron ring 1 = ByCenter_Mag 2 = ByCenter_Cap 3 = ByResonance RimSyncMode 0 = ByNone 1 = ByCenter_Mag 2 = ByCenter_Cap 3 = ByTBD AmplitudeControlMode 0 = ByNone 1 = ByRim_Mag 2 = ByCenter_Cap 3 = ByTBD	u_int_32 b 0: Drive_SyncMode bit 0 b 1: Drive_SyncMode bit 1 b 2: Clear "DidResyncMyself" bit b 3: Force Resync b 4: RimSyncMode bit 0 b 5: RimSyncMode bit 1 b 6: Spare b 7: Send FrequencyWord to DDS b 8: AmplitudeControlMode bit 0 b 9: AmplitudeControlMode bit 1 b 10: Spare b 11: Invert HalfSwing b 12: EnableDetectorCenterPass_Mag b 13: EnableDetectorCenterPass_Cap b 14: Spare b 15: Spare b 16 .. 23: Spare b 24: Force Maximal Drive Current b 25: Force Minimal Drive Current b 26: Enable Drive Pulses b 27: Spare b 28: Store EEPROM (parms changed) b 29: Spare b 30: Spare b 31: Reset Arduino	
4, 5	TStartLookForCenter_Mag	u_int_16	
6, 7	TMissedCenter_Mag	u_int_16	
8, 9	TStartLookForCenter_Cap		
10, 11	TMissedCenter_Cap		

12, 13	TStartLookForRim1_Mag	u_int_16	Magn
14, 15	TMissedRim1_Mag	u_int_16	Magn
16, 17	TStartLookForRim2_Mag	u_int_16	Magn
18, 19	TMissedRim2_Mag	u_int_16	Magn
20, 21	SetPoint_Amplitude_ticks	u_int_16	
22, 23	TDrive_Start	u_int_16	
24, 25	TDrive_Stop	u_int_16	
26, 27	Drive_MinimalCurrent	u_int_16 0..1023	10 bit PWM
28, 28	Drive_MaximalCurrent	u_int_16 0..1023	10 bit PWM
30 .. 33	DDS_FrequencyWord	u_int_32	
34, 35	Divider_T5	u_int_16	
36, 37	Divider_Final	u_int_16	

Table 4 Message from Arduino to GUI: Size = 75 bytes. (with some margin)

Byte nr C++ = Pascal	**Purpose**	**Value, Range**	**Remark**
0	Message Length	Byte	= String length in Pascal
1, 2	VERSION_NUMBER	u_int_16	Y (MMDD) mod 2000
3 .. 6	Status	u_int_32 b 0: SeenCenter_Mag b 1: MissedCenter_Mag b 2: SeenCenter_Cap b 3: MissedCenter_Cap b 4: SeenRim1_Mag b 5: MissedRim1_Mag b 6: SeenRim2_Mag b 7: MissedRim2_Mag b 8: HalfSwing b 9: Have Sync b 10: b 11: Touch_Charron b 12: UsingMaximalDriveCurrent b 13: UsingMinimalDriveCurrent b 14: b 15: DDS_Frequency changed. b 16: OutofRange Center_Mag b 17: OutofRange Center_Cap b 18: OutofRange Rim1_Mag b 19: OutofRange Rim2_Mag b 20: OutofRange North b 21: OutofRange South b 22: OutofRange East b 23: OutofRange West b 24: b 25: b 26: b 27:	

		b 28: ReadEEpromError b 29: DriveWasON b 30: BME280 init Error b 31: CheckSumError_Arduino_In	
7, 8	Adc_Center_Cap	u_int_16	actual ADC value
9, 10	APeakCenter_Cap	u_int_16	peak value found
11, 12	ABaseCenter_Cap	u_int_16	averaged base level. Measured when Bob is far away.
13, 14	TPassCenter_Cap	u_int_16	
15, 16	AHalfHeightCenter_Cap	u_int_16	
17, 18	WidthCenter_Cap	u_int_16	
19, 20	Adc_Center_Mag	u_int_16	actual ADC value
21, 22	APeakCenter_Mag	u_int_16	peak value found
23, 24	AMidCenter_Mag	u_int_16	averaged mid-level, Measured when Bob is far away.
25, 26	TPassCenter_Mag	u_int_16	
27, 28	Adc_Rim_Cap	u_int_16	Actual value, No further support
29, 30	Adc_Rim_Mag	u_int_16	Actual value
31, 32	AMidRim_Mag	u_int_16	Measured when bob is near Center.
33, 34	APeakRim1_Mag	u_int_16	
35, 36	TPassRim1_Mag	u_int_16	
37, 38	APeakRim2_Mag	u_int_16	
39, 40	TPassRim2_Mag	u_int_16	
41, 42	Adc_North	u_int_16	actual ADC value
43, 44	Adc_South	u_int_16	actual ADC value
45, 46	Adc_East	u_int_16	actual ADC value
47, 48	Adc_West	u_int_16	actual ADC value
49 .. 52	PositionCounter_PMS	u_int_32	Position at time of sending PMS data.
53 .. 56	DDS_FrequencyWord	u_int_32	When Changed by Phase control
57, 58	TResonanceDrive	u_int_16	
59, 60	BME_Temperature	s_int_16	deci degrees C
61, 62	BME_Baro	u_int_16	milliBar / 10
63	BME_Hygro	Byte	% relative
64	CheckSum	Byte	