SYS-File: 70097978v170.SYS
SYS-File Family: 70089377
Hardware: MC024_110_lg(11130919) MC024-112(11130920)

1 General

BIOS Functionality; The functionality is defined around the pin. If no *Variable Type* is specified the *Variable Name* contains elements, defined later. The pins are defined as C(ConnectorNumber)p(PinNumber).
Example:
The pin C1p02 has 2 variables; C1p02.AnIn, C1p02.Volt.

Etc.

Contents

2 BIOS Variables

2.1 Digital Inputs

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C1p06	-			
C1p07	-			
C1p10	-			
C1p11	-			
C1p12	-			
C2p01	-			
Elements				
DigIn	BOOL	Read	Digital Input True = Active	**Note2**
PinConfig	U16	Write	Configuration 0 = Activated with 5 V ... Supply Voltage No Pull-Down, No Pull-Up 1 = Activated with Ground(Active Low) No Pull-Up to internal +5V 2 = Activated with 5 V ... Supply Voltage Active High Pull-Down	**Note2**
PinStatus	U16	Read	Status 0 = OK 1 = Config Error	**Note2**

2.2 Analog Inputs

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C1p05	-			
Elements				
AnIn	U16	Read	Analog In 0-32767	AD Count
Volt	U16	Read	Analog in scaled [mV]	0..5250mV

2.3 Analog Inputs (Ana/Temp/Rheo)

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C2p07	-			
C2p08	-		Range = 0..5.25 V, 0..10000[Ω]	Resistance measure is non linear

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
Elements				
AnIn	U16	Read	Analog In 0-32767	AD Count
Volt	U16	Read	Analog in scaled [mV]	0..5250mV
Ohm	U16	Read	Analog in scaled [Ω](=65535 if this signal is not valid)	
PinConfig	U16	Write	Config 0 = Normal Analog Input 1 = Temperature / Rheostat Mode	**Note2**
PinStatus	U16	Read	Status 0 = OK 1 = Config Error	

2.4 Multi function Inputs (Dig/Ana/Freq)

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C2p02	-			
C2p03	-			
C2p04	-			
C2p05	-			
C2p06	-			
Elements				
DigIn	BOOL	Read	Digital In True = Active	
AnIn	U16	Read	Analog In 0-32767	AD Count
Volt	U16	Read	Analog in scaled [mV]	Depending on range selection
Freq	U16	Read	Frequency in scaled [Hz]	If the frequency input is too high the programm will stop executing. The limit is about 300 kHz.
Per	U32	Read	Period in scaled [0.1μs]	
Count	U16	Read	Number of measured counts this loop	
Duty	U16	Read	Positive duty cycle in scaled [0.01%]	
QuadCount	S16	Read	Number of measured counts this loop, sign defines direction.	Only valid when FreqConfig = 1

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
Phase	S32	Read	Phase shift [0.1μs], sign defines direction. defines direction.	Only valid when FreqConfig = 2
PinConfig0	U16	Write	Config 0 = Digital Input activated with 5V..Supply voltage (No Pull Down, No Pull Up 1 = Digital Input activated with Ground (Pull Up to internal +5V) 2 = Digital Input activated with 5V..Supply voltage (Pull Down) 3 = Digital Input activated with Supply Voltage (Pull Down, Pull Up to internal +5V)	**Note2**
PinConfig1	U16	Write	Config 0 = 0...5.25 Volt range (middle range) Threshold when measuring frequency: Rising Min/Max 2.73V/3.99V Falling Min/Max 0.96V/2.68V 1 = 0...0.3675 Volt range (low range) Thresholds when measuring frequency: Rising Min/Max 0.191V/0.279V Falling Min/Max 0.067V/0.187V 2 = 0...35.5 Volt range (high range) Threshold when measuring frequency: Rising Min/Max 18.3V/26.8V Falling Min/Max 6.5V/18.0V 3 = 0... 2.465 Volt range (Not recommended to use because of lower resolution)	**Note2** Note; with some frequency measurements (elements;.QuadCount and .Phase) the maximum frequency is 4000 Hz
DigInConfigLow	U16	Write	Config Digital Input threshold Low[mV] Default value 2000 **If activated with 5V..Supply** This will define when DigIn goes from True to False. **If activated with Ground** This will define when DigIn goes from False to True.	**Note2**
DigInConfigHigh	U16	Write	Config Digital Input threshold High[mV] Default value 3000 **If activated with 5V..Supply** This will define when DigIn goes from False to True. **If activated with Ground** This will define when DigIn goes from True to False.	**Note2**

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
FreqConfig	U16	Write	Config 0 = No additional measure mode 1 = Quad encoder enabled, result in .Quad-Count 2 = Phase shift enabled, result in .Phase In addition to any of the three modes described above, bit 8 has the following meaning: 0 = Frequency filtering enabled 1 = Frequency filtering disabled(raw values returned)	**Note2** Only on C2p02, C2p05
PinStatus	U16	Read	Status 0 = OK 1 = Config Error	
FreqStatus	U16	Read	Status 0 = OK 1 = Config Error	

2.5 Multi function Outputs

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C2p09	-			
C2p10	-			
C2p11	-			
C2p12	-			
Elements				

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
PinConfig	U16	Write	Config 0 = Digital Output Output defined by variable .DigOut Push/Pull OutPut 1 = Digital Output Output defined by variable .DigOut Sourcing OutPut 2 = Digital Output Output defined by variable .DigOut Sinking OutPut 3 = PWM Output Output defined by variable .OutputValue Range 0...10000[0.01%pos duty] 4 = PWM Output (current control) Output defined by variable .OutputValue Range 0...30000[0.1mA] 5 = PWM Output (current control) Output defined by variable .OutputValue Range 0...30000[0.1mA] Dither Enabled 6 = PVE Output Output defined by variable .OutputValue Range 0...10000[0.01% of PVE Power] 7 = Hbridge Output .Enabling C2p09-C2p10 outputs for hbridge, set C2p09.PinConfig to 7 .Enabling C2p11-C2p12 outputs for hbridge, set C2p11.PinConfig to 7 Output defined by variable .OutputValue Range 0...10000[0.01%pos duty] 8 = PWM Output (current control bidirectional) .Enabling C2p09-C2p10 outputs for bdir, set C2p09.PinConfig to 8 .Enabling C2p11-C2p12 outputs for bdir, set C2p11.PinConfig to 8 Output defined by variable .OutputValue Range 0...30000[0.1mA] Dither Enabled	**Note2** **Note3** PVE Power appr. Supply Voltage
PinStatus	U16	Read	Status 0 = OK 1 = Config Error 2 = Overload	**Note4**
DigOut	BOOL	Write	Digital out True = Supply Voltage	Note:Maximum update rate is set by corresponding ReqFreq

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
OutputValue	U16	Write	Set point 0...30000 [0.1 mA] 0...10000 [0.01% pos duty] 0...10000 [0.01% of PVE Power]	
AnIn	U16	Read	Raw value for FeedbackValue, used for production test. 0-32767 (16384 = 0 current)	AD Count
FeedBackValue	S16	Read	Actual Value current [0.1 mA]	
ActPWM	U16	Read	Actual Vakue duty 0...10000 [0.01% pos duty]	
DitherFreq	U16	Write	Set point Dither Frequency 40..250[Hz]	**Note3**
DitherAmp	U16	Write	Set point Dither Amplitude 0..5000[0.1mA]	**Note3**
CurChgLim	U16	Write	Limit for current change if PinConfig = 4 or 5 22...333[0.1 mA/ms], Default 111	**Note2** C2p09 sets the limit for C2p09_C2p10 C2p11 sets the limit for C2p11_C2p12

2.6 Multi function Outputs Group Settings

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C2p09_C2p10	-			
C2p11_C2p12	-			
Elements				
ReqFreq	U16	Write	Set point Frequency 30..4000[Hz], Default 1000	**Note2** **Note3**
ActFreq	U16	Read	Actual Value Frequency [Hz]	**Note3**

2.7 Monitoring

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C1p02	-		Range = 0-33 V Battery Voltage averages 1024 samples every 109uS for an update rate of 112mS	
Elements				

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
AnIn	U16	Read	Analog In 0-32767	AD Count
Volt	U16	Read	Analog in scaled [mV]	

2.8 Sensor Power

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
C1p08	-		Range = 3-12 V	
Elements				
AnIn	U16	Read	Analog In 0-32767	AD Count
Volt	U16	Read	Analog in scaled [mV]	Sensor supply voltage

2.9 OS

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
OS	-			
Elements				
Start	BOOL	Read	Set during the first processing time.	
LoopCnt	U32	Read	Counter that increment by 1 every processing time.	
ExecTime	U16	Read	processing time [ms]	
ExecTimeOut	U16	Write	Requested processing time 1-250[ms] Default: 10[ms]	**Note1** **Note7**
ExecTimeWork	U16	Read	Actual work time during processing time [ms]	
ETime	U32	Read	Time since power on [10ms]	
ChecksumFailure	U16	Read	**Bit0** True = Flash checksum error False = Flash check OK **Bit1** True = RAM checksum error False = RAM check OK **Bit2** True = Bootloader checksum error False = Bootloader check OK	These elements are set during start-up of the device. Bit 0 will be true if OS.CrcFailed = 2.

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
ChecksumFailure-Treatment	U16	Write	**Bit0** True = All outputs will be turned off/set to tri-state automatically in case of a Flash checksum error. Application will not be executed. False = Application continues to run. Default: True **Bit1** True = All outputs will be turned off/set to tri-state automatically in case of a RAM checksum error. Application will not be executed. False = Application continues to run. Default: True **Bit2** True = All outputs will be turned off/set to tri-state automatically in case of a Bootloader checksum error. Application will not be executed. False = Application continues to run. Default: False	**Note1**
CrcFailed	U16	Read	0 = CRC calculation matches 1 = CRC calculation is not implemented 2 = CRC calculation does not match 3 = CRC data missing; unable to perform test 4 = CRC calculation is in progress 5 = CRC is not present in the downloaded file	The CRC calculation is performed on the programm memory which corresponds to bit 0 in OS.ChecksumFailure.

2.10 LED

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
Led	-			
Elements				
Green	BOOL	Write	Green LED True = On	
Red	BOOL	Write	Red LED True = On	

2.11 NVMem

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
NVMem	-			
Elements				
Status	U16	Read	Status of Non-Volatile memory after reset. The status code is bit coded. **Bit 0** True = The NV Memory was restored to a previous state. This may happen when a store operation was aborted. For example due to power off. **Bit 1** True = The NV Memory checksums are not correct. This may, for instance, occur during the first boot up after a new application is downloaded, if the NV Memory usage is changed. **Bit 2** True = The reset routine could not access the NV memory. This may, for instance, occur due to a hardware problem. **Bit3-15** Reserved	

2.12 Service Tool Access

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
ServiceTool	-			
Elements				
MasterPassword	-			
Elements				
Write	U32	Read	True = This value can be read by the Service Tool even if .DisableRead is True.	
Read	U32	Write	this value can be written by the Service Tool even if .DisableWrite is True. It can also be read by the Service Tool even if .DisableRead is True.	
DisableRead	BOOL	Write	True = The Service Tool has no read access to the unit.	
DisableWrite	BOOL	Write	True = The Service Tool has no write access to the unit.	
DisableDownload	BOOL	Write	True = The Service Tool has no access to download any file to the unit.	
Connect	BOOL	Read	True = The unit has received a Service Tool Command during the last excecution loop.	

2.13 Packed Infoblock

The packed infoblock contains data about the controller, application and embedded operating system of a hardware unit. Each field consists of a number of bytes which are packed in arrays of U16 in little endian byte order.

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
ECUInfoPacked	-			
Elements				
AppCmplTime	ARRAY[4]U16	Read	Application compilation time stamp in the format yy yy mm dd hh mm ss cc, where each of the four elements is a hexadecimal number representing four digits. Consider the following example: If an application is compiled December 2nd 2009 at 16:54:49.22 this is presented as {0x0920, 0x0212, 0x5416, 0x2249}.	cc=1/100s
AppId	ARRAY[26]U16	Read	Application identity. It consists of a null terminated ASCII string. As an example, Untitled is presented as {0x6E55, 0x6974, 0x6C74, 0x6465, 0x0000}.	
AppType	ARRAY[16]U16	Read	Application type. It has the same format as AppId.	
AppVer	ARRAY[11]U16	Read	Application version. It has the same format as AppId.	
BDate	ARRAY[4]U16	Read	Production time stamp in the same format as AppCmplTime.	
BootVer0	U16	Read	Bootloader version. It is a 16 bit number.	
PNr0	ARRAY[6]U16	Read	Part number 0. It consists of a right justified ASCII string padded with space characters; e.g. a part number equal to 1002096 is presented as {0x2020, 0x2020, 0x3120, 0x3030, 0x3032, 0x3639}.	
PNr1	ARRAY[6]U16	Read	Part number 1. It has the same format as PNr0.	

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
PNr2	ARRAY[3]U16	Read	Part number 2. It is a numerical value. As an example, consider the part number 025125980137. Its hexadecimal representation is 0x05D9A007E9 and this number is presented as {0x07E9, 0xD9A0, 0xXX05}, where XX is undefined and should be masked away.	**Note6**
PRev0	ARRAY[2]U16	Read	The revision level of part number 0. It consists of four ASCII characters. For example, a revision level equal to RevA is presented as {0x6552, 0x4176}.	
PRev1	ARRAY[2]U16	Read	The revision level of part number 1. It has the same format as PRev0.	
SerNr0	ARRAY[3]U16	Read	40 bit serial number. It has the same format as PNr2.	

2.14 Identity

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
ID	-			
Elements				
Node	-			
Elements				
ServerAddr	U8	Write	The node number of this unit.	**Note1**
ClientAddr	U8	Read	The node number of the diagnostic tool.	
Net[n]	-		n = 0	
Elements				
Addr	U8	Write	The net number, n = 0.	**Note1**

2.15 CAN

CAN-Controller internal in CPU is used for CAN[0] (C1p03-C1p04) bus.
In addition to the following Application Interface, CAN[0] can be used for diagnostics and for download.
Following CAN-signals are implemented.

BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous

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BIOS-name	Variable Type	Variable Direction	Function, Scaling	Miscellaneous
CAN[n]	-		n = 0	
Elements				
Baudrate	U32	Write	Default 250000 baud Supported baud rates: 50000 100000 125000 250000 500000 1000000	**Note2**
BussOff	BOOL	Read	Set = The CAN controller is in Bus Off mode.	
Reset	BOOL	Write	Set = Resets the CAN controller and Bus off mode.	
DriverError	BOOL	Read	Set = The CAN driver could not be initialized and the whole CAN functionality is shut down. For CAN[0] this flag could be set if other CAN-Nodes already communicate during initialization phase.	
DriverReset	BOOL	Write	Set = Reinitialize the CAN driver if DriverError is Set.	
ErrorPassive	BOOL	Read	Set = The Can controller is in error passive state.	
Overflow	BOOL	Read	Set = The internal CAN message queue was full during the last execution loop. A message may have been lost.	
Port	PORT	Read	A handler for the CAN port x, used as an input to a CAN symbol to select which CAN port to use.	

3 Notes

3.1 Note1

This signal must use the symbol "Intialize Hardware Output". "Initialize Hardware Output" means that this output will be updated before the application starts.

3.2 Note2

This signal can use both symbols "Intialize Hardware Output" and "Hardware Output". "Initialize Hardware Output" means that this output will be updated before the application starts. "Hardware Output" means that this output will be updated every loop in the application.

3.3 Note3

Dither is working on channel groups and .
Dither amplitude (.DitherAmp) works individually for each channel.
Changing .DitherAmp resets the current control for the pin group of the affected pin.
If .OutputValue is non-zero it must be greater than or equal to 1.5 * .DitherAmp;otherwise the requested current will

be incorrect.
(Ex: If .DitherAmp is set to 20 mA and .OutputValue is set to 100mA the command will vary from 80 mA to 120 mA.)

When Dither is enabled (.PinConfig = 5 or 8) on one channel all channels in that group will receive the base frequency 4000Hz regardless of the setting of group.ReqFreq. This activity will be reported in group.ActFreq.
The Dither frequency will be the same for all channels in a group.
When switching back to other PWM functions (dither disabled) the base frequency is set to the value give by group.ReqFreq.
The Dither enabled channel (.PinConfig = 5 or 8) with the highest pin number in each group (ex:)
determines the required Dither frequency. (Ex: If pins 37 and 39 are using dither, the frequency assigned to pin 39 will be used).
True Dither frequencies are: 40, 50, 80, 100, 125, 154, 200,250 Hz. Frequency values (.DitherFreq) will be rounded to the closest True Dither frequency.

3.4 Note4

After an Overload condition it is recommended to set the set point for the output with either DigOut or OutputValue (depending on PinConfig) to False or 0 for 250 ms to reset the Overload condition properly.

3.5 Note6

.PNr2 may be either a part number or an EAN number. If the formula below matches it is a part number; if the high byte of .PN2[2] is a valid EAN checksum it is an EAN number.
PNr2[2]:HB = CRC8(PNr2[0]:LB ...PNr2[2]:LB)
where:
LB = low Byte
HB = high Byte
CRC8 =8 Bit CRC with polynomial is x8 + x2 + x + 1; startvalue to be 0xFF

3.6 Note7

If the processing time exceds the value Z then the processor will be reset and the application restarted. Z is calculated as follows: If T < THEN Z = 30 ms ELSE Z = 5*T ms. Where T = OS.ExcecTimeOut for the first loop and T = OS.ExcecTime after the first loop.

4 Miscellaneous

All scaling and ranges presented are nominal values. More technical details can be found in PLUS+1 Controller Family Technical Information. Maximum nested levels are 10
Maximum number of supported NV memory cells is 3500 .
PLUS+1 GUIDE 7.1.10 or higher is required.

4.1 Supported PLUS+1 GUIDE Components

The following PLUS+1 GUIDE components which need support from the SYS are allowed

- Get Time us
- Until
- Repeat
- Initialize Hardware Output
- Sin
- Cos
- Tan
- Square Root
- Arc Sin
- Arc Cos
- Arc Tan

- Hardware Input
- Read Output from Hardware
- Module Input
- Module Bus Input
- Module Bus Output
- Access App Log Enable
- Set Pulse
- Disable Raw Applog Data Readout
- Accessrights App Log Statistics
- Accessrights App Log Errors
- Accessrights App Log Others
- Accessrights History
- Accessrights Read
- Accessrights Write
- Create Externally Defined Class
- Call Method Of Externally Defined Class
- Transmit CAN
- Receive CAN Basic
- Receive CAN with ID Mask
- Receive CAN with Filter
- Close Parameter Set

4.2 Diagnostic Data (PLG) In Target

Diagnostic Data (PLG file) is dynamically allocated in target FLASH memory.

4.3 ToolKey

"LOGKEY" Supported.

4.4 TimeBase

The following time bases are supported

- T1M
- T10M
- T100M
- T1S
- T60S
- T1H
- TLOOP

4.5 Unit History

Unit History is supported. The 20 latest activities are logged.

4.6 Read-Only Parameters Support

This software supports Multiple Read Only Parameters. 16384 bytes are allocated and there is theoretically no limit on the number of files that can be used. However, the minimum size for each file is 230 bytes, so no more than 71 files can be used.
This SYS has a parameter named ReadOnlyParameters which enables or disables this function. The parameter can have the values ENABLE or DISABLE. DISABLE is the default value. This value can be set in the GUIDE. Select this SYS in the Project manager and Edit the Parameter in the Inspector. NOTE: The memory calculation will not be correct when the ReadOnlyParameters is in ENABLE mode. The total amount of ROM should be reduced by 8192 to get the correct calculation.
Needed information for csv file:

```
ADDRESSMODE:     LSBFIRST
DEFAULTTYPEDATA: 1
MIN_DATASIZE:    8
```

4.7 Compiled Code Package Support

This software supports compiled_code package (CCP) using IDL type .

4.8 HOST-settings

In General the PLUS+1 Setup program does this.
This setting use STM32FX0X Compiler v4.7.4, Key is; ARM-GCC 4.7 2013Q2-20130614