Dipl.-Ing. Kramert GmbH

Instruction Manual

Encoder Counter Module

ECM-514 A   / REV: 5

All technical data subject to change without notice.

November 16, 2015   © Dipl.-Ing. Kramert GmbH, CH-5236 Remigen

FPGA Revision History:

REV 0, 19.3.2007, Checksum 1EDE3C3:	
REV 2, 03.07.2007, Checksum 1EF5973:	Statusregister HFF0..3 flip-flops changed to HL0..3 latches.
REV 3, 05.07.2007, Checksum 1EF5915:	Statusregister Bit(31..17) ID-Number 0x514A implemented. Double function of frontpanel leds (see page 5) Maximum count speed changed to 16 MHz.
REV 4, 10.11.2007, Checksum 1EEE1AB:	Option B implemented (see page 5)
REV 5, 16.11.2015, Checksum 1EC4D3E	Option T implemented (see page 5)

Description

The function of this module is to continuously read data from 4 incremental encoder sensors. The sensor data is stored in dual ported memory. This memory is readable via the VME-bus.

The module ECM-514-A is the successor of module ECM-504-A.

New features:

The sensor counter registers are extended from 24bit to 32bit.

There are four new **index registers**. The purpose of the index register is to measure the precise location of the index pulse (also known as 'reference mark' or 'home switch').

The minimum **input pulse** width is 120ns (compared to 2µs of the ECM-504-A) which gives a maximum count speed of 16 MHz (compared to 500kHz of the ECM-504-A).

For software compatibility of the ECM-514-A VME module with the ECM-504-A VME module, the memory space of both modules is exactly the same. The same EPICS software driver can be used to read both modules.

The VME-address range is selected by a 2x8bit dip switch (address selector, A31..A17). This address range is accessible via read and write commands (A32, D32; or A24, D32). The extended address range is selected via jumper switch. The occupied memory is always 128 kByte.

The **control and status register** of the 514-A module is in parts identical to the status register of module 504-A. This register is used to perform the following functions for each channel individually:
1. Enable/disable the reset of the sensor register when an index pulse is received (EN0..EN3). 0 = 'reset is disabled', 1 = 'reset is enabled'. A zero also clears the corresponding 'home latch' (see below).
2. Program the count direction (VR0..VR3). Note: 'VR' means 'Vorwärts/Rückwärts'.
3. Show the encoder's reference mark by setting the 'home latches' (HL0..HL3) to high. This function is only active if the corresponding ENx bit is 1. A zero in the ENx bit clears the 'home latch' to zero.
4. Clear the sensor and index registers (CLR0..CLR3). 0 = 'count', 1 = 'clear'.
5. Shows the module (ID) identification number 0x514A or 0x514B.

The control and status register allows read/write access, except the four 'home latch' bits and the module ID, which are read-only.

Backward compatibility

There are small changes in the manual dip switch functions, see below.
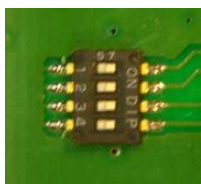
ECM-514 SUB-PRINT Dip Switch Settings

SMD-DIP-SWITCH:
Each Channel is controlled by 2 dip switches.
Function:
Top channel: S1-OFF Changes counter direction (UP<->DOWN); Default: OFF
                                  S2-OFF Invert Z polarity; default: OFF
Bottom channel: S3-OFF Changes counter direction (UP<->DOWN); Default: OFF
                                  S4-OFF Invert Z polarity; default: OFF

Note: The dip switch ON position overrules the values in the control and status register.

VME Interface

Bit Assignment:

Sensor Register (0x00..0x0C)

Bit	Function	Access
D0..D31	Sensor Data (32bit)	R

Triggered Sensor Register (0x10..0x1C)

Bit	Function	Access
D0..D31	Triggered-Sensor Data (32bit)	R

Index Register (0x40..0x4C)

Bit	Function	Access
D0..D31	Index Data (32bit)	R

Control and Status Register (0x80)

Bit	Function	Access
D0..D3	EN0..EN3	R/W
D4..D7	VR0..VR3	R/W
D8..D11	CLR0..CLR3	R/W
D12..D15	HL0..HL3	R
D16..D31	Module ID 0x514A/B	R

(see page 4-5: option switches)

VME-Registers

Base address + offset:			
0x00	Sensor 1	0x20..0x3C	Not used
0x04	Sensor 2		
0x08	Sensor 3	0x40	Index 1
0x0C	Sensor 4	0x44	Index 2
0x10	T-Reg Sensor 1	0x48	Index 3
0x14	T-Reg Sensor 2	0x4C	Index 4
0x18	T-Reg Sensor 3	0x50..0x7C	Not used
0x1C	T-Reg Sensor 4	0x80	Control & Status

Each sensor has its own index register. The index register is fed with exact the same signals as the sensor register except the index register is not reset by the index pulse of the encoder. Therefore the index register enables you to measure:

+ The position of an index pulse relative to an end limit or home switch
+ The width of an index pulse
+ The repeat accuracy of an index pulse

Example: Measure repeat accuracy of index pulse:
1. Enable home switch of sensor 1 register
2. Clear sensor 1 register (index 1 register is automatically cleared too)
3. Slide sensor 1 over its reference mark (encoder generates index pulse, sensor 1 register resets)
4. Calculate the difference of sensor 1 register and index 1 register (e.g. 0x155)
5. Slide sensor 1 over its reference mark again (encoder generates index pulse, sensor 1 register resets)
6. Calculate the difference of sensor 1 register and index 1 register (e.g. 0x159)

If the index pulse occurs repeatedly at the same point, the difference should remain the same. However, you may find that the difference changes depending on the direction of the movement or is different when moving several times over the reference mark from the same direction. In other words, the index registers enable you to measure the reliability of the reference mark positions.
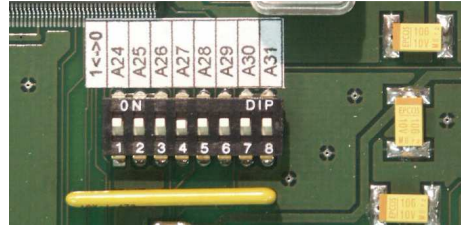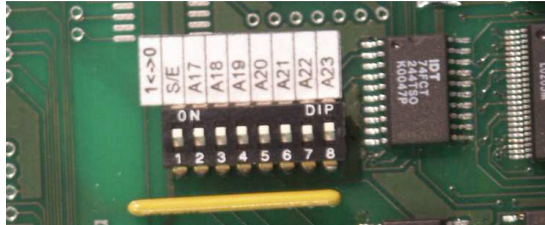
VME Base Address

The address range is selected by two 8bit dip switches (address selector, A31..A17). This address range is accessible via read commands (A32D32 or A24D32).

The RAM of the ECM-504 is located between base address + 0x00..0xFF.
The base address can be mapped with the dip switches to 128kByte boarders within the VME address space.

Access via   A24D32   Standard
               A32D32   Extended

This Standard/Extended address range switch is marked on the print with „S/E". Standard address range (A24) is selected with the switch in the OFF position. The extended address selector switch (A31..A24) is then disabled.

Base address	A31 ... A24	A23	A22	A21	A20	A19	A18	A17		A24/A32 Switch
with the STA/EXT-Switch = 1: STANDARD										
0x000000	x	0	0	0	0	0	0	0		**1**
0x020000	x	0	0	0	0	0	0	1		**1**
0x040000	x	0	0	0	0	0	1	0		**1**
0x060000	x	0	0	0	0	0	1	1		**1**
with the STA/EXT-Switch = 0: EXTENDED										
0x00000000	0	0	0	0	0	0	0	0		**0**
0x00020000	0	0	0	0	0	0	0	1		**0**
0x00040000	0	0	0	0	0	0	1	0		**0**

a.s.o.

Address Modifier:

	Addressing Space	AM-Codes
STA	STANDARD A2..A23	3D, 39
EXT	EXTENDED A2..A31	0D, 09

Boot and Option Switches:
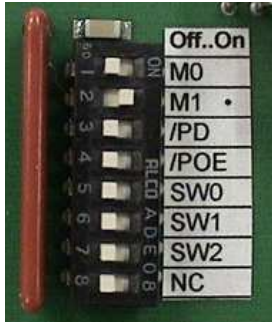
 BOOT-SW: M0, M1, /PD, /POE, NC:
This is the default position. These switches define the bootmode of the module and **must** stay at their default positions.

OPTION-SW:

SW0	ON/OFF	Option T (default = left = disabled)
SW1		Reserved for future options
SW2	ON/OFF	Option B (default = left = disabled)

The module has actually two additional functions implemented. If nedded activate these functions with DIP-Switch SW0..SW2.

SW0 Option T:
- Enabled by Dip-SW0
- AUX-IN of CH0 is used as a global trigger input.
- At the rising edge of the trigger-signal all four encoder counters are latched into the related T-Registers at address 0x10, 0x14, 0x18 and 0x1C

SW2 Option B:
- Module ID is switched to 0x514B
- VME SYSRESET does not clear the ECM-514 module. This preveserves the counter and register content when the system reboots or resets.

Temperature Range: Ventilated VME-Crate is required
Power Requirements: Approximately 1 A at +5V
Physical: Single width VME module

Front Panel Connectors

Encoder IN CH-0	9-pol. D-SUB female RS422 Encoder input, impedance 120 Ohm
RESET	Push-Button,CH-0 Chip Reset
AUX-IN	Clear CH0 Counter (Special function with Option T !) TTL Schmitt Trigger LEMO Input, impedance 1kOhm pullup, low active
CH 0,1 LED	Shows LSB of the 32-bit encoder counters or if ENx=1 LEDx Shows HomeLatch HLx, x=0,1
Encoder IN CH-1	9-pol. D-SUB female RS422 Encoder input, impedance 120 Ohm
RESET	Push-Button,CH-1 Chip Reset
AUX-IN	Clear CH1 Counter TTL Schmitt Trigger LEMO Input, impedance 1kOhm pullup, low active
Encoder IN CH-2	9-pol. D-SUB female RS422 Encoder input, impedance 120 Ohm
RESET	Push-Button,CH-2 Chip Reset
AUX-IN	Clear CH2 Counter TTL Schmitt Trigger LEMO Input, impedance 1kOhm pullup, low active
CH 2,3 LED	Shows LSB of the 32-bit encoder counters or if ENx=1 LEDx Shows HomeLatch HLx, x=2,3
Encoder IN CH-3	9-pol. D-SUB female RS422 Encoder input, impedance 120 Ohm
RESET	Push-Button,CH-3 Chip Reset
AUX-IN	Clear CH3 Counter TTL Schmitt Trigger LEMO Input, impedance 1kOhm pullup, low active

Pin Assignment 9-pol. D-SUB Connector			
Pin	Function	Pin	Function
1	GND	6	A-
2	A+	7	Z-
3	Z+	8	B-
4	B+	9	GND
5	+5V DC		