# 89 460/112 ED





# OPERATING PRINCIPLE



# **EWM-SS-DAD**

CARD FOR AXIS SYNCHRONIZATION CONTROL FOR SYSTEMS FROM 2 TO 24 AXES WITH PROFIBUS/CAN COMMUNICATION INTERFACE SERIES 10

# RAIL MOUNTING TYPE: DIN EN 50022

- This card has been developed as axes controller and it is connected to the other cards via Canbus. This bus line has to be coupled with a PLC interface Profibus DP, the EWM-BUS-DD/10 (to be ordered separately).
- The EWM-SS-DAD synchronizes the axes with a high accuracy. The position accuracy is reached using a digital sensor with SSI interface to measure the position. The card can drive only an hydraulic axis per card, so a EWM-SS-DAD per axis is needed.
- The synchronization controller correct the speed of the slave axis. Positioning failures during the movement will increase or reduce the slave axis velocity, so the synchronization failure will be compensated.
- The card use the RS232C interface, and is easily settable via notebook, using the software kit (EWMPC).

Power supply	V DC	12 ÷ 30 ripple included - external fuse 1,0 A
Current consumption	mA	< 200 + sensor power consumption
Command value		via Profibus DP - ID number 1810h
Speed input value		via Profibus DP - ID number 1810h
Feedback value	V mA SSI	$\begin{array}{l} 0 \div 10 \; (R_{I}=33 \; k\Omega) \\ 4 \div 20 \; (R_{I}=250 \; \Omega) \\ \text{digital sensor with any SSI interface} \end{array}$
Output value: - E0 version - E1 version	V mA	$\pm 10$ (max load 5 mA) 4 $\div$ 20 (max load 390 $\Omega$ )
Position accuracy		± 2 bits of digital sensor resolution
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-3 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions - EWM-SS-DAD - EWM-BUS-DD	mm	120 x 99(h) x 46(w) 120 x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

### **TECHNICAL CHARACTERISTICS**

# **1 - IDENTIFICATION CODES**

#### 1.1 - Profibus / CAN coupler code



This electronic module is developed for controlling of hydraulic drives in synchronization. The communication with the PLC is solved by a standard Profibus DP interface.

A typical repeatable positioning accuracy of up to 0,01% with analogue sensors or up to 0,001 mm with digital SSI sensors can be achieved. Proportional valves with integrated electronics (typically with control valves) can be driven by the analogue differential output.

Internal profile generation (acceleration time, max. velocity and stroke depended deceleration) provides fast and excellent positioning. The drive works in open loop mode and is switched over in closed loop during deceleration. This is a time-optimal positioning structure with very high stability. An extra Numeric Control mode can be used for a speed controlled profile generation (VMODE = ON).

The synchronization control works as a second overriding velocity/position controller. Failure between the axes will be compensated by adjusting the speed of the slave axis.

The card sample time is 2 ms, up to 5 ms with 24 axes to drive.

### 2 - EWM-SS-DAD FUNCTIONAL SPECIFICATIONS

#### 2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

#### 2.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

#### 2.3 - Digital Input (ENABLE)

The digital input must have a voltage from 12 to 24 V; Low level: <4V, high level >12V with current <0,1A. See the block diagram at paragraph 8 for the electric connections. Apply to PIN 8 the 24V to enable hardware.

#### 2.4 - Reference signal

The reference signal is run through the card-bus and addressed to the individual modules via Profibus, ID number 1810h (see par. 10).

#### 2.5 - Input feedback values

The card works both with digital (SSI) or analog sensors.

- SSI: parameters are settable via software (see SSI parameters in the table on next page).
- ANA: The analogue signal must be voltage 0 ÷ 10V with RI = 33 k $\Omega$ or current 4 ÷ 20 mA (250 $\Omega$ ), with RI = 250 k $\Omega$ The analogue resolution is of 0,01% of the sensor stroke.



Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

#### 2.6 - Output values

E0 version: output voltage 0 ±10 V (standard).

E1 version: output current 4 ÷ 20 mA. (max load 390  $\Omega$ )

#### 2.7 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level <4V; High level >10V (  $I_{max}$  50 mA with load of 200 $\Omega)$ 

# **3 - LED FUNCTIONS**

There are two leds on the EWM-SS-DAD card:

GREEN: Shows if the card is ready.

ON - The card is supplied and ENABLE hardware e software ON OFF - No power supply or the ENABLE HW/SW is inactive FLASHING - Failure detected (internal or 4 ÷ 20 mA). Only if the parameter SENS is ON

YELLOW: Is the signal of the control error monitoring. ON - No control error, system in closed loop control. OFF - Error detected or START signal not active.

### PARAMETERS TABLE

## 4 - ADJUSTMENTS

On the EWM cards the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the commands and its uses.

The parameters changes depending on the card model.

Commands	Parameter	Defaults	Units	Description
inpx	X= SSI ANA	SSI	-	Selection of the sensor input channel. The standard is a digital sensor with SSI
				specification at the corresponding connections (clamps 25 to 28 and 31, 32).
				Alternatively an analogue input which is indicated in the command as
				parameters ANA can be used.
ainti a h a u	2 — VT			Analogue input evaluation (anku) XI for the input signal
ain:i a b c x	1= XL a= -10000 10000	. 1000	_	Analogue input scaling (only). <b>AL</b> for the input signal. $\mathbf{V} = \text{voltage input}$ and $\mathbf{C} = \text{current input}$ . With the parameters <b>a</b> , <b>b</b> and <b>c</b> the
	b = -10000 10000	: 1000	-	inputs can be scaled (output = $a / b^*$ (input - c))
	c= -10000 10000	: 0	0,01%	Because of the programming of the $\mathbf{x}$ -value ( $\mathbf{x} = \mathbf{C}$ ) the corresponding input will
	x= V C	: V	-	be switched over to current automatically. (see NOTE)
num	X= 0 24	2	-	Number of modules used in synchronization system.
stroke x	X= 2 5000	500	mm	Length of the sensor. The length of the stroke sensor is needed for the scaling of the analogue input and for the calculation of the braking stroke.
ssioffset x	X= -30000 30000	0	0,01 mm	Zero point adjustment of the sensor.
ssires x	X= 10 1000	1000	0,001 mm	Resolution of the sensor.
				The highest resolution (1000) corresponds to 1 $\mu$ m. This sensor resolution is always used for the input data via Profibus and is needed for the internal calculations. (see <b>NOTE</b> )
ssibits x	X= 8 32	24	-	Data protocol length in bits
ssicode x	X= GRAY BIN	GRAY	-	Transmitting code of the sensor.
ssipol x	X= +   -	+	-	Sensor polarity. In order to reverse the working direction of the sensor, the
				polarity can be changed via this command. In any case also the SSIOFFSET
				has to be adjusted.
				Ex: Sensor length = 200 mm opposite working direction. SSIPOL is set on "-" and SSIOFFSET on 20000.
a:i x	i= A B	:A 100	ms	Acceleration time depending on direction.
	x= 1 2000	:B 100	ms	The ramp time is separately set for driving out ( <b>A</b> ) and for driving in ( <b>B</b> ). Normally <b>A</b> = flow P-A, B-T and <b>B</b> = flow P-B, A-T.
d:i x	i= A B S	:A 2500	0,01%	Deceleration stroke depending on direction.
	X= 50 10000	:B 2500	0,01%	This parameter is set in 0,01% units of the maximum length of the sensor. The
		:5 1000	0,01%	braking distance is set dependent from the direction. The controller gain will be
				calculated by means of the braking distance. The shorter the braking distance
				braking distance should be set
				The parameter <b>D</b> indicates the ratio between the maximum sensor length and
				and a indicated stopping point; will become active after the removal of the
				'START' signal only .
ctrl x	x= lin sqrt1	sqrt1	-	Selection of the control function: (see NOTE)
	sqrt2			lin = standard linear P-control,
				sqrt1 = progressive time optimized deceleration curve
				sqrt2 = sqrt1 with a higher gain in position
syncmode x	X= MS   AV	MS		Synchronization mode.
				$\mathbf{MS}$ - Master/Slave.all axes are following the master axis (axis further 1) $\mathbf{AV}$ - Averages calculation: the command position will be calculated by the
				averages of all axes.
glp x	X= -10000 10000	500	0,01	Parameter of the synchronisation control function. (see NOTE) The SYNC-
t1 x	X= 0 100	10	ms	controller works as a PT1 compensator for optimized controlling of hydraulic
				drives. Critical drives can be stabilized with the T1 factor.
vramp x	x= 1 2000	200	ms	Ramp time for the external velocity. Operating shocks can be reduced when
				changing the external velocity.

in OFF state the stoke depended deceieration is active; the velocity preset limits the output signal. Not state a profile generator gen	vmode x	x= on off	off	-	Activation of the NC-generator.		
initia the output signal.     initia the output signal.     in ON state a profile generator generates the positioning demand value and the axis drives to the target position with the defined velocity.       vel     x     X= 120000     50     mm/s     Internal maximum velocity preset.       min:1     x     1= A1B     7.0     0.018     Good digutament will increase position with VODDE = ON.       max:1     x     1= A1B     7.0     0.018     Good digutament will increase positioning accuracy       max:1     x     0.0200     7.018     Good digutament will increase position with control valves.       regger x     1= A1B     7.1000     0.018     Maximum output signal. Adapt the control range to maximum flow range.       trigger x     x= 02000     200     0.018     Maximum output signal. Adapt the control range to maximum flow range.       regger x     x= 02000     200     0.018     Maximum output signal. Adapt the control range to maximum flow range.       regger x     x= 02000     200     0.018     Maximum output signal. Adapt the control range to maximum flow range.       regger x     x= 02000     200     0.018     Maximum output signal. Adapt the control range to maximum flow range.       regger x     x= 02000     200     0.018     Maximum output signal. Adapt the control range to maximum flow range.       regger x     x= -2002000 <th></th> <th></th> <th></th> <th></th> <th>In OFF state the stroke depended deceleration is active; the velocity preset</th>					In OFF state the stroke depended deceleration is active; the velocity preset		
In ON state a profile generator gen					limits the output signal.		
vol       x       X= 1 20000       S0       rm/s       istic drives to the target position with the defined velocity. The stroke time is defined by the parameter VEL.         vol       x       X= 1 20000       S0       rm/s       infernal maximum velocity preset. This parameter is only active in cessop of VMODE = ON.         min:1       x       1= A IB x= 0 5000       A 0       0,018       Maximum output signal. Adapt the control range to maximum flow range. 0,018         trigger x       x       0.000       0,018       Maximum output signal. Adapt the control range to maximum flow range. 0,018         inpose x       x= 0 5000       200       0,018       Asso useful for reduced sensitivity in position with control valves.         inpose x       x= 0 5000       200       0,018       Sinchronization error. Asso useful for reduced sensitivity in position with control valves.         inpose x       x= 0 5000       200       0,011m       This parameter is entered in 0.01 mm units. The INPOS command defines the window when he INPOS message is in control valves.         inpose x       x= -2000 2000       200       0,011m       This parameter is entered in 0.01 mm units. The INPOS command defines the window when he INPOS message. The control error control. With the parameter is entered in 0.01 mm units.         inpose x       x= -2000 2000       0       0.011m       The senaremonitoring cone bactual value + offest.VW					In ON state a profile generator generates the positioning demand value and the		
val         x         X=1_2000         S0         mm/s         Internal maximum velocity presel. The stroke time is defined by the parameter Vel.           minii         x         1= A1B         1A         0         0.01%         Geadband compensation of positive overlapped proportional values. x= 05000         1B         0         0.01%         Geadband compensation of positive overlapped proportional values. Geadband compensation of positive overlapped proportional values. x= 02000         200         0.01%         Geadband compensation of positive overlapped proportional values. Geadband compensation for solutive coverlapped proportional values. Maximum output signal. Adapt the control range to maximum flow range. 0,01%         Maximum output signal. Adapt the control range to maximum flow range. National defines the window when the INPOS marks representation of positive propensation (min). (see NOTE) Also useful for reduced sensitivity in position with control values. The positioning process is not influenced by this message is indicated. The positioning process is not influenced by this message. The control with the INPOS command defines the window when the INPOS message is indicated. The positioning process is not influenced by this message. The control with the ISERROR value the synchronization error talue can be compensated.           poll         x = -20002000         0         0.01%         Zero point adjustment. The corresponding OFSET will be added to the control form (demand value - actual value + offset). With this parameter is onterior (demand value - actual value + offset). With this parameter is the value actual value + offset).           poll         x = -20002000					axis drives to the target position with the defined velocity		
velXX-1200050rm/siterating by the summer by					The strake time is defined by the peremeter VEL		
vel       x       x       1.2000       50       mm/s       Internal maximum velocity preset.         msin:i       x       1.41B       A.0       0.013       Deadband compensation of positive overlapped proprionial valves.         max:i       x       1.4.1B       7.4.1000       0.013       Deadband compensation of positive overlapped proprionial valves.         max:i       x       1.4.1B       7.4.1000       0.013       Deadband compensation of positive overlapped to maximum flow range.         trigger x       X = 0.2000       200       0.014       Maximum output signal. Adapt the control range to maximum flow range.         glexror x       X = 0.2000       200       0.011M       Synchronization error.         glexror x       X = 0.2000       200       0.011M       Synchronization error.         glexror x       X = -20002000       0       0.01M       The Positioning process is not influenced by this message. The control error.         controller remain sative.       In NPOS command edifies the window when the INPOS message is indicated. The positioning process is not influenced by this message. The control error.         prime:       x = -20002000       0       0.014       Zoro (demand value = actual value + offset). With this parameter is ontered in 0.01 mm window is the componitation error window is the offset). With this parameter is ontered in 0.01 mm window is the offset)					The stroke time is defined by the parameter VEL.		
Image: Instrument of the second of the sec	vel x	X= 1 20000	50	mm/s	Internal maximum velocity preset.		
min:i       x       1 = A IB x = 0500       :A       0       0,118 0,018       Deadband compensation of positive overlapped proportional valves. Good adjustment will increase positioning accuracy Bood adjustment will increase positioning accuracy         max:i       x       i = A IB x = 5000					This parameter is only active in case of VMODE = ON.		
A1 = 101000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000 <th>min·i v</th> <th>i= A   B</th> <th>• 2 0</th> <th>0.018</th> <th>Deadband comparisation of positive overlapped propertianal valves</th>	min·i v	i= A   B	• 2 0	0.018	Deadband comparisation of positive overlapped propertianal valves		
max:1       x       1= A 1000       1= 0       0,018       Gudd adjustment Num indexa possibility in control range to maximum flow range.         max:1       x       1= A 1000       1= 10000       0,018       Point to activate the deadband compensation (min). (see NOTE) Also useful for reduced sensibility in position with control valves.         inpose x       X= 05000       200       0,018       Point to activate the deadband compensation (min). (see NOTE) Also useful for reduced sensibility in position with control valves.         inpose x       X= 05000       200       0,01mm       Synchronization error.         giterror x       X= 05000       200       0,01mm       Synchronization error.         giterror x       X= 05000       200       0,01mm       This parameter is entered in 0,01 mm units.         new reduction of the component o	min.i x	x = 0 5000	.R 0	0,01%	Cood adjustment will increase positioning accuracy.		
max:i       i = A1B       i: A 1000       0, 014       Maximum output signal. Adapt the control range to maximum flow range.         trigger x       X = 0 2000       0.013       Point to activate the deadband compensation (min). (see NOTE)         inpos x       X = 0 5000       200       0.013       Synchronization error.         glezroz x       X = 0 5000       200       0,01mm       Synchronization error.       This parameter is entered in 0.01 mm units.         trigger x       X = 0 5000       200       0,01mm       Synchronization error.       This parameter is entered in 0.01 mm units.         glezroz x       X = -2000 2000       0       0,01mm       Synchronization error.       This parameter is entered in 0.01 mm units.         trigger x       x = -2000 2000       0       0,01m       Synchronization error.       This parameter is entered in 0.01 mm units.         trigger x       x = -2000 2000       0       0,018       Zero point adjustment. The corresponding OFFSET will be added to the control red ror (demand value - actual value + offset). With this parameter the zero point failure can be compensated.         pol x       x = -1 =       +       -       Output polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.         sens       x       = on1off       on       -       Reloading		x= 0 5000		0,01%	Good adjustment will increase positioning accuracy		
Letigger XX = 500012 1000012 100000,01%Point to activate the deadband compensation (min), (see NOTE) Also useful for reduced sensitivity in position with control valves.inpos x glerror xX = 050002000,01mm 200Synchronization error. This parameter is entered in 0.01 mm units. The INPOS command defines the window when the INPOS message is indicated. The positioning process is not influenced by this message is indicated. The positioning process is not influenced by this message. The controller remains active. In NC-mode (VMODE = 00H) this message has to be interpreted as following error control. With the GLERROR value the synchronization error window is defined.offset xx = -2000 200000,01mCommand entry and error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.pol xx = +1-+-Output polarity. All A and B adjustments depend on the output polarity. The fight polarity should be defined first.sens xx = onloffon-The sensor monitoring can be activated (with 4 20 mA sensors).saveOutput polarity. All A and B adjustments depend on the output polarity. The fight polarity should be defined first.sens xx = onloffonCorr deviation as activated (with 4 20 mA sensors).saveOutput polarity. All A and B adjustments depend on the output polarity. The fight polarity should be defined first.sens xx = onloffonCorr deviation as activated (with 4 20 mA sensors).save <th< th=""><th>max:i x</th><th>i= A B</th><th>:A 10000</th><th>0,01%</th><th colspan="3">Maximum output signal. Adapt the control range to maximum flow range.</th></th<>	max:i x	i= A B	:A 10000	0,01%	Maximum output signal. Adapt the control range to maximum flow range.		
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ImposImposImposAlso useful for reduced sensitivity in position with control valves.inposX= 0 50002000,0 ImmSynchronization error.glerror XX= 0 50002000,0 ImmControl defines the window when the INPOS message is indicated. The positioning process is not influenced by this message. The controller remains active.offset XX= -2000 200000,0 ImmZero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter tac zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter tac zero point adjustment actual value + offset). With this parameter tac zero point adjustment actual value + offset). With this parameter tac zero point error (demand value - actual value + offset). With this parameter tac zero point adjustment be compensated.pol xx= +1-*Coupt polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.sense xx= on loffon-The sensor monitoring can be activated (with 4 20 mA sensors).saveCoupt polarity. The right polarity should be defined first.saveCoupt polarity should be defined first.saveCoupt polarity. The right polarity should be defined first.saveCoupt polarity. The right polarity should be defined first.saveCoupt polarity. The right polarity should be defined first.save	trigger x	X= 0 2000	200	0,01%	Point to activate the deadband compensation (min). (see NOTE)		
inpos       x       X= 0 5000       200       0,01mm       Synchronization error. This parameter is entered in 0,01 mm units. The INPOS command defines the window when the INPOS message is indicated. The positioning process is not influenced by this message. The controller remains active. In NC-mode (VMODE = ON) this message has to be interpreted as following error control. With the GLERROR value the synchronization error window is defined.         offset x       x= -20002000       0       0,01%       Zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.         pol       x = + -       +       -       Output polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.         sens       x = on loff       on       -       The sensor monitoring can be activated (with 4 20 mA sensors).         save       -       -       Storing the parameter from EPROM.       200         loadback       -       -       Reloading the parameter is with all programmed values.         rcopy       -       -       -       Actual parameter is with all programmed values.         rtis command value *1       -       -       -       Transfer of the parameter is into all other modules. This command is carried out usually during the first basic installation.         stat       -       -       -       Coutput					Also useful for reduced sensitivity in position with control valves.		
glerror xx= 0 50002000,01mmThis parameter is entered in 0,01 mm units. The INPOS command defines the window when the INPOS message is indicated. The positioning process is not influenced by this message. The controller remains active. In NC-mode (VMODE = ON) this message has to be interpreted as following error control. With the GLERROR value the synchronization error window is adfined.offset xx= -2000 200000,01%Zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.pol xx= +1-+-Output polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.sens xx= on loffon=The sensor monitoring can be activated (with 4 20 mA sensors).aaveCourtpolarity is programmed parameter from EPROM.loadbackCourtpolarity is adjustment from EPROM.ordgingCourtpolarity is adjustment from EPROM.paraCourtpolarity is adjustment from EPROM.copyCourtpolarity is adjustment in all modules. The parameters into all other modules at the node CAN. The parameters are stored in the EEPROM.stcopystTransfer of the parameters into all other modules at the node CAN. The parameters are stored in the EEPROM.st	inpos x	X= 0 5000	200	0,01mm	Synchronization error.		
a bit is in the interval       -       -       The INPOS command defines the window when the INPOS message is indicated. The positioning process is not influenced by this message. The control error indicated. The positioning process is not influenced by this message. The control error control. With the GLERROR value the synchronization error window is defined.         offset x       x= -2000 2000       0       0,01%       Zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.         pol x       x= +1-       +       -       Output polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.         sens x       x= onloff       on       -       The Sensor monitoring can be activated (with 4 20 mA sensors).         save       -       -       -       Storing the programmed parameter in EPROM.         loadback       -       -       -       Reloading the parameter from EPROM in working RAM         help       -       -       -       Transfer of the parameters into all other modules.         copy       -       -       -       Transfer of the parameters into all other modules.         stat       -       -       -       Transfer of the parameters into all other modules.         stat       -       -       -       Transfer of the parame	glerror x	x = 05000	200	0.01mm	This parameter is entered in 0.01 mm units		
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offset x       x= -2000 2000       0       0.0       0.0       2 arrow off and a sequence of the set of the					indicated. The positioning process is not influenced by this massage. The		
offset x       x= -200 2000       0       0,018       Zero point adjustment. The corresponding OFFSET will be added to the control defined.         pol x       x= +1-       -       0,018       Zero point adjustment. The corresponding OFFSET will be added to the control arror (demand value - actual value + offset). With this parameter the zero point failure can be compensated.         pol x       x= +1-       +       -       Output polarity. All A and B adjustments depend on the output polarity. The right polarity should be defined first.         sens x       x= on1off       on       -       The sensor monitoring can be activated (with 4 20 mA sensors).         save       -       -       -       Storing the programmed parameter in EPROM.         loadback       -       -       -       Reloading the parameter from EPROM.         help       -       -       -       Reloading the parameter into all other modules.         para       -       -       -       Actual parameter is into all other modules.         copy       -       -       -       -       Control deviation.         st       -       -       -       -       Control deviation.         st       -       -       -       -       Control deviation.         st       -       -       -       -					indicated. The positioning process is not initialized by this message. The		
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sens       x       x= on off       on       -       The sensor monitoring can be activated (with 4 20 mA sensors).         save       -       -       -       Storing the programmed parameter in E*PROM.         loadback       -       -       -       Reloading the parameter from E*PROM in working RAM         help       -       -       -       Reloading the parameter from E*PROM in working RAM         para       -       -       -       Actual parameter list with all programmed values.         copy       -       -       -       Actual parameter sits with all programmed values at the node CAN. The parameters are stored in the EEPROM. Caution: All up to now adjusted values are overwritten in all modules. This command is carried out usually during the first basic installation.         st       -       -       -       -       Internal status. Monitoring of the control and status word (see par. 10). Command available via software only.         w1       Demand value xw Control deviation kx w ysinc position kxw w ysinc position kxii       -       -       Preset values will be set.         w1       Actuator signal x:i       -       -       -       -       Preset values will be set.					The right polarity should be defined first.		
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x1     Actual value     -     0,01 min     The process data can be read out via soliwate.       x1     Actual value     -     -     The process data can be read out via soliwate.       xw     Control deviation     -     -     They show the actual and command values       xw     Sync position     -     -     -       xw     Sync error     -     -     Preset values will be set.	wl	Demand value	_	0.01 mm	The process data can be read out via software		
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xw     control deviation       kx     Sync position       kxw     Sync error       v     Velocity       u     Actuator signal       x:i     Indexed axes process       default     -	A1 	Control doristiss			They show the actual and command values		
xx     Sync position       xxw     Sync error       v     Velocity       u     Actuator signal       x:i     Indexed axes process       default     -     -         Preset values will be set.	X.W 1	control deviation					
kxw     Sync error       v     Velocity       u     Actuator signal       x:i     Indexed axes process       default     -     -         Preset values will be set.	KX .	Sync position					
v     Velocity       u     Actuator signal       x:i     Indexed axes process       default     -     -       Preset values will be set.	KXW	Sync error					
u     Actuator signal     Image: Signal       x:i     Indexed axes process     Image: Signal       default     -     -   Preset values will be set.	v	Velocity					
x:i     Indexed axes process     Image: Comparison of the set of	u	Actuator signal					
default Preset values will be set.	x:i	Indexed axes process					
	default	-	-	-	Preset values will be set.		

#### NOTE about the AIN command: This command is for analogue sensor only.

With this command each input can be scaled individually. For the scaling function the following linear equation is taken: output signal =  $a / b^*$  (*input signal - c*).

At first the offset (c) will be subtracted (in 0,01% units) from the input signal, then the signal will be multiplied with factor  $\mathbf{a} / \mathbf{b}$ .  $\mathbf{a}$  and  $\mathbf{b}$  should always be positive. With these both factors every floating-point value can be simulated (for example: 1.345 = 1345 / 1000).

With the x parameter value the internal measuring resistance for the current measuring (4... 20 mA) will be activated (V for voltages input and C for current input). ATTENTION: This resistor is never activated at the k input.

	AIN:X	а	b	С	x	
i with voltage:	AIN:i	1000	1000	0	V	
i with current:	AIN:i	1250	1000	2000	С	

**NOTE about the SSIRES command**: the standard of measurement is defined as increment/mm (inkr/mm). The maximum available resolution is equal to 1 µm that corresponds to a value 1000.

Example: A sensor with resolution 5 $\mu$ m has a resolution (0.005 mm) 5 times lower than the maximum set. The SSIRES value is calculated as follows: 1000 (full scale ink) / n (sensor resolution in  $\mu$ m) = 1000 / 5 = 200

**NOTE about the CTRL command**: This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT\*: Root function for the calculation for the braking curve.

SQRT1: with small control error. control gain corresponds to 30000 / d:i ; SQRT2: control gain corresponds to 50000 / d:i



**NOTE about the GLP and T1 command:** Both controllers (sync and positioning) are working parallel. The higher the sync-gain the lower must be the gain of the positioning controller. A time constant value (T1) can be used to damp the sync-controller for better stability.

Simplified control structure:



**NOTE about the TRIGGER command**: With this command, the output signal is adjusted to the valve characteristics. The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stabile positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module. If the MIN value is set too high, it influences the minimal velocity, which cannot be adjusted any longer. In extreme case this causes to an oscillating around the closed loop controlled position.



# **5 - INSTALLATION**

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of  $0.75 \text{ mm}^2$ , up to 20 m length and of  $1.00 \text{ mm}^2$  up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

**NOTE:** To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Also the Profibus cable must be screened.

Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by DIL switches.

For the installation of the EWM-BUS-DD only a few steps are necessary (CAN-side).

Electric connection: the CAN Bus of the modules is wired with the CAN Bus of the coupler.

EWM-SS-DAD:	PIN 23	at PIN	EWM-BUS	-DD 1
EWM-SS-DAD:	PIN 22	at PIN	EWM-BUS	-DD 4
EWM-SS-DAD:	PIN 21	at PIN	EWM-BUS	-DD 3
Power supply:	PIN 5 and	9 PIN 6	= 24 V	
	PIN 7 and	1 PIN 8	= 0 V	

#### 5.1 - CAN interface

The CAN interface is wired on all modules in parallel. The terminating resistors have to be activated in the EWM-SS-DAD at the first and last module.

The addressing of the EWM-SS-DAD about the DIL switches must begin with one. The first module has a master functionality and takes over the communication with the interface converter EWM-BUS-DD. The DIL-switch is inside the unit on the interface board opposite of the main board. Position and switch position are marked.

DIL switches (the DIL switch is on the interface board):

- 1 to 5: Binary coding of the postal address of the node. At the most 24 addresses are managed.
- 8: Terminal resistance: only at the first and last module the terminal resistance is activate.

Example: EWM-SS-DAD configuration node address 1.



For all the cards the default adress is type "Master"; so it is necessary for each card to select the correct adress in according to the number of axis (see example paragraph 8.1).

### ADRESSES TABLE FOR EWM-SS-DAD NODE

DIL ->	1	2	3	4	5
NODE					
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON

## 6 - PROFIBUS/CANbus card EWM-BUS-DD

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate. The functionality is defined in IEC 61158. The Profibus address can be programmed by a terminal program, EWMPC/10 or online via the Profibus.

The reference values are preset over the digital Profibus / CAN-Bus that worked with full internal resolution. The position resolution corresponds to the sensor resolution.

TIn the EWM-BUS-DD the presetting is to be maintained for the CAN-Bus (address 2 and 1 MBd).

DIL Switches configuration for module EWM-BUS-DD:



DIL Switches is inside the module and it gives the possibility to set address and data transmission speed.

tables below show the meaning of DIL Switches:

DIP-SWITCH							
1	1 2 3 4 5 6 7						
	CANBUS		TRANSI SPI	MISSION EED			

TRANSMISSION	DIP-SWITCH			
SPEED	6	7		
125 Kbaud	OFF	OFF		
250 Kbaud	ON	OFF		
500 Kbaud	OFF	ON		
1 Mbaud	ON	ON		

#### 6.1 - Display

The EWM-BUS-DD has a display that shows the module status:

- everything OK, Profibus and CAN Bus in data exchange
- 1 Error, CAN Bus no data exchange
- 2 Error, Profibus no communication
- 3 Error, Profibus no communication, CAN Bus no data exchange
- 4 Error, Profibus OK, not connected CAN Bus
- 5 Error, Profibus no communication, not connected CAN Bus
- 6 Error, hardware fault

#### 6.2 - ProfiBUS port

A shielded typical Profibus connector (9-polig), possibly with internal terminal resistors, must be used .The pre addressing of the module can be changed only by Profibus (DEFAULT is 3). The cable is not included.

#### PROFIBUS PORT WIRING AND LINKING CONFIGURATION



pin	Signal name	Function
1-2-7-9	not used	-
3	RxD/TxD-P (B-Line)	Receive/Send P data
4	CNTR-P/RTS	Request to Send
5	DGND	Data ground
6	VP	+5 V DC for external bus termination
8	RxD/TxD-N (A-Line)	Receive/Send N data

#### 7 - SOFTWARE KIT EWMPC/10 (code 3898401001)

The software kit comprising a USB cable (2 mt length) to connect the card to a PC or notebook and the software.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

# 8 - WIRING DIAGRAMS FOR EWM-SS-DAD\*E0 AND EWM-BUS-DD



# DIGITAL INPUT AND OUTPUT

- PIN READY output:
  - 1 General operationally, ENABLE is active and there is no sensor error (by use of 4 ÷ 20 mA sensors). This output corresponds with the green LED.
- PIN ENABLE input:
- 8 This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

#### ANALOGUE INPUT AND OUTPUT

- PIN Analogue feedback value (X),
- 14 range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
- PIN Differential output (U)
- 15/16 ±100% corresponds to ± 10V differential voltage, optionally (E1 version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)



### 8.1 - Wiring for 4-axes synchronization

### 9 - EWM-DD-DAD CARD BLOCK DIAGRAM



# **10 - PROFIBUS COMMUNICATION**

The Profibus board controls the modules by sending 8 bytes of data, which contain information on two control words, the command position (position setpoint) and speed control (speed setpoint). The EWM-SS-DAD cards send back to the bus-card two status words, the nominal current position and current actual position, for a total of 24 bytes of data.

Using ST command in EWMPC, those data can be read out. and they appearing in this way:

	(high	byte / low byte)
control word :	1110	1000 / 0000 0000
control word 2 :	0010	0000 / 0010 0000
status word :	1101	0000 / 1101 0000
status word 2 :	0010	0000 / 0010 0000
position setpoint:	22400 Ifff	(command position in HEX via Profibus) (command speed in HEX via Profibus)

Enable: enabled (module = enabled (Profibus & Hardware-enable))

#### 10.1 - Data sent to the axes

The EWM-BUS-DD card is set as follows: (Hi = High byte; Lo = low byte)

Byte	Function	Comment
0	control word Hi	unsigned int
1	control word Lo	
2	command position Hi	unsigned long
3	command position	
4	command position	
5	command position Lo	
6	velocity Hi	unsigned int
7	velocity Lo	
8	control word 2 Hi	unsigned int
9	control word 2 Lo	
10 - 23	reserved	no function

### 10.1.1 - Axes control

Only the first four axes may be activated individually, the other axes must be enabled for groups of four axes at a time, with the indicator x SEL, according to the following:

Address	Controlled axes					
SEL	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 24
2	0	0	0	0	1	1
1	0	0	1	1	0	0
0	0	1	0	1	0	1

#### 10.1.2 - Control words

The control words contain the following informations:

	0
ENABLE:	Must be activated in addition to the hardware signal.
START:	In case of increasing edge the current command
	position is taken over, in case of deactivated
	START the system about a brake ramp is stopped.
GL-ACTIVE:	Over this bit the overlapped synchronism controller
	is activated.
SEL x:	Groups of each four modules with the information
	ENABLE: START: GL-ACTIVE: SEL x:

about status and positions can be read - by the control of the three select-bits -back.

Byte 0 - control word Hi		
bit	Function	
0	Axis START 4	start 1 = active
1	Axis START 3	start 1 = active
2	Axis START 2	start 1 = active
3	Axis START 1	start 1 = active
4	SEL 2	selection 1 = active
5	SEL 1	selection 1 = active
6	SEL 0	selection 1 = active
7	Enable (with which enable hardware links)	operation 1 = active

Byte 1 - control word Lo		
bit	Function	
0	GL- Active ext 2 (axis 9 to 12)	1 = GL active (group 2)
1	GL- Active ext 1 (axis 5 to 8)	1 = GL active (group 1)
2	START ext 2 (axis 9 to 12)	1 = start (group 2)
3	START ext 1 (axis 5 to 8)	1 = start (group 1)
4	GL- Active axis 4	synch 1 = active
5	GL- Active axis 3	synch 1 = active
6	GL- Active axis 2	synch 1 = active
7	GL- Active axis 1	synch 1 = active

Byte 8 - control word 2 Hi		
bit	Function	
0	Reserved	
1	Reserved	
2	Reserved	
3	START ext 5 (start of axis 13 to 16)	1 = start (group 5)
4	START ext 4 (start of axis 17 to 20)	1 = start (group 4)
5	START ext 3 (start of axis 13 to 16)	1 = start (group 3)
6	Reserved	
7	Reserved	

<b>EWM-SS-DAD</b>
SERIES 10

Byte 9 - control word 2 Lo		
bit	Function	
0	Reserved	
1	Reserved	
2	Reserved	
3	GL- Active ext 5 (axis 21 to 24)	1 = GL active (group 5)
4	GL- Active ext 4 (axis 17 to 20)	1 = GL active (group 4)
5	GL- Active ext 3 (axis 13 to 16)	1 = GL active (group 3)
6	Reserved	
7	Reserved	

# 10.1.3 - Position setpoint description

Command position: according to the sensor resolution.

Byte 2 to 5 - command position			
bit	Function defined by the sensor resolution		
from 0 to 7	Command position Lo byte	Byte 5	
from 8 to 15	Command position	Byte 4	
from 16 to 23	Command position	Byte 3	
from 24 to 31	Command position Hi byte	Byte 2	

Example of calculation of position control for SSI sensor resolution = 5  $\mu$ m and 100% stroke = 300 mm.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 200 = 60.000 (dec) → EA60 (hex)

50% di 60.000 = 30.000 (dec)  $\rightarrow$  7530 (hex)

Example of calculation of position control for ANA sensor with 100% stroke = 300 mm. With analog sensors ssiREs value is preset and unchangeable.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 1000 = 300.000 (dec)  $\rightarrow$  493E0 (hex) 50% di 300.000 = 150.000 (dec)  $\rightarrow$  249F0 (hex)

Position setpoint to be sent



hex 00 02 49 F0



#### 10.1.4 - Speed setpoint description

Command velocity: 0x3fff corresponds to 100 %.

Byte 6 and 7 - command velocity			
bit Function max value 0x3FFF			
from 0 to 7	velocity Lo byte	Byte 7	
from 8 to 15 velocity Hi byte Byte 6			

#### 10.2 - Updating data

The EWM-SS-DAD cards send back to the bus-card two status words, the received setpoint command and the current actual position, totally of 24 bytes of data.

Byte	Function	Comment
0	status word Hi	unsigned int
1	status word Lo	
2	control position* Hi	unsigned long
3	control position*	
4	control position*	
5	control position* Lo	
6	status word 2 Hi	unsigned int
7	status word 2 Lo	
8	actual pos. axes 1,5,9,13,17,21 Hi	unsigned long
9	actual pos. axes 1,5,9,13,17,21	
10	actual pos. axes 1,5,9,13,17,21	
11	actual pos. axes 1,5,9,13,17,21 Lo	
12	actual pos. axes 2,6,10,14,18,22 Hi	unsigned long
13	actual pos. axes 2,6,10,14,18,22	
14	actual pos. axes 2,6,10,14,18,22	
15	actual pos. axes 2,6,10,14,18,22 Lo	
16	actual pos. axes 3,7,11,15,19,23 Hi	unsigned long
17	actual pos. axes 3,7,11,15,19,23	
18	actual pos. axes 3,7,11,15,19,23	
19	actual pos. axes 3,7,11,15,19,23 Lo	
20	actual pos. axes 4,8,12,16,20,24 Hi	unsigned long
21	actual pos. axes 4,8,12,16,20,24	
22	actual pos. axes 4,8,12,16,20,24	
23	actual pos. axes 4,8,12,16,20,24 Lo	

(\*) If the average-value control is active (SYNCMODE = AV) the acknowledged value is the calculated position; If the MASTER/SLAVE (SYNCMODE = MS) is active the acknowledged value will be the command position.

Current command position: is interpreted according to mode differently.

Standard mode : target command position NC-mode : (VMODE = ON) calculated command position

of the generator.

Actual position: according to the sensor resolution.

Example: reading the value of stroke 299251:



### 10.2.1 - Status word descriptions

READY:	System is ready.
INPOS:	Depending on the mode set, can transmit a position or, in NC mode, the following error control information.
GL-ERROR: T	he synchronism error is indicated over this bit by the parameter GLERROR dependently.

SENSOR ERROR: When the sensor monitoring is activated, the READY signal is deactivated with a sensor error.

COMERROR: Communication error on the CAN Bus. This message will be sent only from the module No. 1. if general communication problems are found or if a module is faulty

Always the hardware enable signal has to be deactivated at a sensor error (READY Signal) or when a COM error appear.

Byte 7 - status word 2 Lo		
bit	Function	
0	reserved	
1	reserved	
2	reserved	
3	reserved	
4	GL-Error axis 4, 8, 12, 16, 20, 24	1= no error Corresponding
5	GL-Error axis 3, 7, 11, 15, 19, 23	signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
6	GL-Error axis 2, 6, 10, 14, 18, 22	
7	GL-Error axis 1, 5, 9, 13, 17, 21	

The status word 2 concerns the messages in the EXTENDED mode.

Byte 0 - status word Hi		
bit	Function	
0	INPOS axis 4	1= in position
1	INPOS axis 3	1= in position
2	INPOS axis 2	1= in position
3	INPOS axis 1	1= in position
4	READY axis 4	1= ready
5	READY axis 3	1= ready
6	READY axis 2	1= ready
7	READY axis 1	1= ready

Byte 1 - status word Lo			
bit	Function		
0	COMerror	1 = no error	
1	reserved		
2	reserved		
3	reserved		
4	axis GL-Error 4	1 = no error	
5	axis GL-Error 3	1 = no error	
6	axis GL-Error 2	1 = no error	
7	axis GL-Error 1	1 = no error	

Byte 6 - status word 2 Hi			
bit	Function		
0	INPOS axis 4, 8, 12, 16, 20, 24	1= no error Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi	
1	INPOS axis 3, 7, 11, 15, 19, 23		
2	INPOS axis 2, 6, 10, 14, 18, 22		
3	INPOS axis 1, 5, 9, 13, 17, 21		
4	READY axis 4, 8, 12, 16, 20, 24	1= Ready Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi	
5	READY axis 3, 7, 11, 15, 19, 23		
6	READY axis 2, 6, 10, 14, 18, 22		
7	READY axis 1, 5, 9, 13, 17, 21		

# 11 - OVERALL AND MOUNTING DIMENSIONS OF EWM-SS-DAD



## 12 - OVERALL AND MOUNTING DIMENSIONS OF EWM-BUS-DD





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