![Atlas Copco logo]

User Guide for

Profibus Protocol on Elektronikon ComBox-P

Name	Mark IV : User Guide			Serc. Class	
Detail	User Guide Profibus Protocol on Elektronikon ComBox-P			**1102 K/1**	
				PC	Owner
Edition	Modified from			Print date	**AII**
06					
Family	Written by CTE-PVT	Compare	Replaces	Designation	
Design checked.	Production checked.	Approved	Date	**9820 3582 03**	

Document Information

Edition	Date	Description	Author
0		Draft update	CTE
01	15/09/2003	Added Turbo and PetPack	CTE-PDJ
		Analogue Outputs (Only for Turbo)	
02	28/09/2004	Added ES800 ,ESMillennium	CTE-PDJ
03	06/07/2005	Changed AV4000 to ZH	CTE-PDJ
04	29/08/2005	Added special Alarms	CTE-PDJ
05	21/12/2006	Turbo commands deleted, Turbo external setpoint deleted , Turbo status changed	CTE-PDJ
06	11/05/2007	Address in HEX	CTE-PDJ
		Status BD AIF dryer changed	
		Status BD AII dryer added	
		ES 6 added	
		ES 130 added	
		MCC Reset Command added	
		Digital Inputs added from 21 to 33	

Table of Contents

1   Preface

This document describes Atlas Copco's Elektronikon MkIV Profibus Profile that is used by the ComBox-P communication processor.

2   The Physical set-up

2.1   Profibus & the Network

In the Elektronikon MkIV system all compressors in an installation can be connected by a data and/or control network. This is done according the Compressor Network Cabling Instruction (9820 3585 00). This instruction explains what connectors and cables should be used to interconnect the different compressors/controllers in the network. Basically this is a CAN-based local network.

In order to setup a profibus connection to one or several of the compressors in this network, a special module as to be inserted in this network.

The Profi-Can DP-Bridge is a hardware and software which allow to Profibus-DP master node (e.g. SCADA or master PLC controller) to access to the data stored in the CAN node's Object Directory. The Bridge is a Profibus-DP slave node which has assigned one Profibus address.   From the Master's point of view, the Bridge acts as a way to access informations of the CANBUS network.
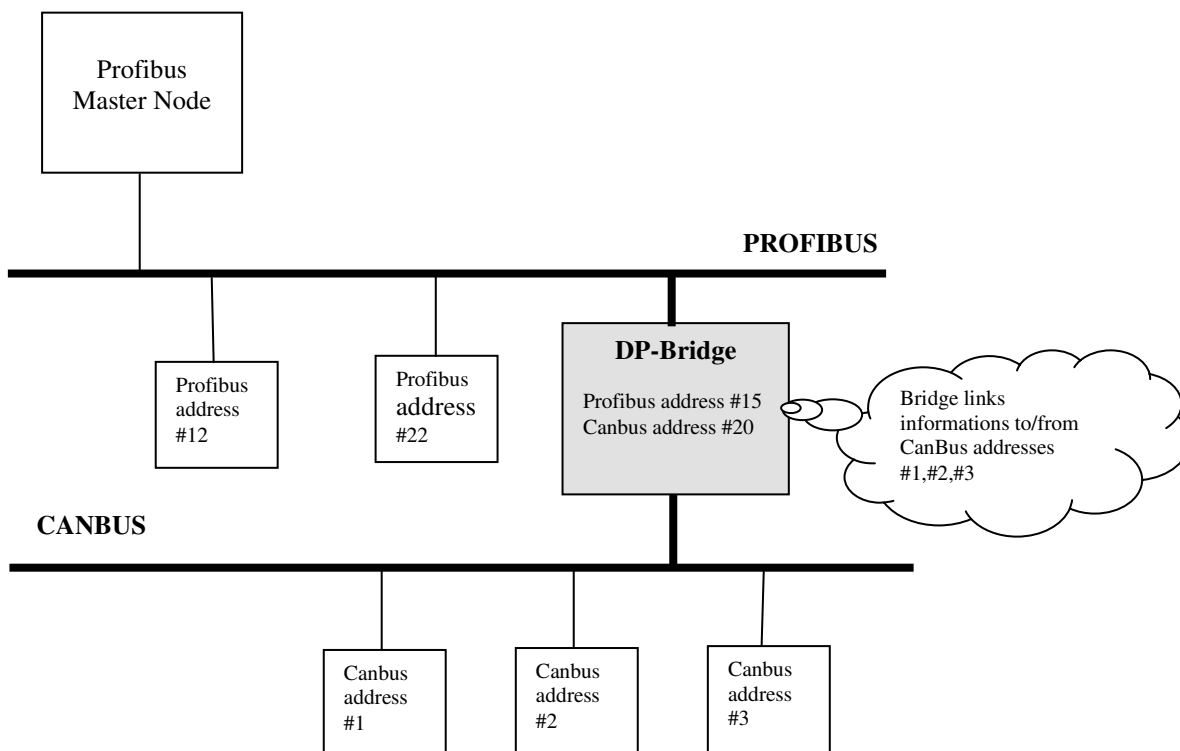
In this drawing the proxy is used to access the compressors with Node Id 1,2 and 3, by using the Profibus addresses 15. The Node Id pf the Combox-P the itself is 20 on the CAN side.

Note: the Profibus manufacturer of the module must create a so named "Electronic Data Sheet" or GSD file that declares the dimensions and the type of the exchanged datas. This file is a public information necessary for Profibus Users to interface with the Combox Profibus DP-bridge. (see Appendix A)

2.2 The Module (Combox-P)

For the bus connection a so-called Combox-P module has to be used (AC n° 19000711 42). By downloading the correct software in it, it will perform the profibus function.

Because this is a general purpose module, not all connections/switches will be used for this connection.
For modbus the following will be used

- 10x14 :
  - to connect a 24Vac supply
- 2 top address switches (LAN)
  - to set the Atlas Copco Lan address (= CAN side address !!),
- 2 bottom address switches (Profibus)
  - to set the Profibus address
- 10x1:
  - to connect to the compressor network (CAN)
- 10x16 :
  - to connect the RS485 Profibus line

The other connectors/switches are NOT used for this application

The module itself can be mounted on a DIN-rail inside one of the compressor cubicles, or on a separate location. Before installation check the available power of the 24Vac transformer, if connecting to an already supplied transformer inside a cubicle..

2.3 LED's

The module also has a number of LED's on type. They are used as follows :

System LED (the most right LED)

Blinking : no program loaded or not running
Lit continuously : program running OK

Application LED's from left to right

1. not used
2. not used
3. CAN receive (Combox receives CAN message)
4. CAN transmit (Combox transmits CAN message)
5. Profibus receive (Combox receives Profibus message)
6. Profibus transmit (Combox transmits Profibus message)
7. not used
8. not used
9. not used
10. not used
11. not used

2.4 Connector lay-out

2.4.1 Power Supply

This is a two pole Wago (type …) connector. Power supply is 24Vac, 10VA

2.4.2 LAN connector

Connect here the cable of the compressor network, according AC instruction : Compressor Network Cabling Instruction (9820 3585 00).

2.4.3 Profibus connection

The module supports the RS485A variant of Profibus, with the following pin-layout and termination requirements as specified

Pin Assignment Profibbus

Sub-D 9 pole female
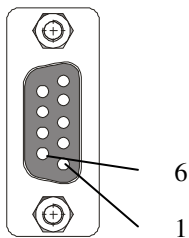
Pin	Function
1	GND
2	Reserved
3	B-signal
4	Resereved
5	GND*
6	+5V*
7	Reserved
8	A-signal
9	Reserved

* galvanic isolated

6

1

3   Basic Protocol

The profile is based on the standard Profibus-DP protocol, with following basic specifications:

- DP-Slave on Siemens SPC3 Asic
- RS485
- Baudrate: 9.600 Kbaud to 12.000 Mbaud
- Autobaud: supported
- Freeze Mode: Not supported
- Sync Mode: Not supported
- Slave Node Address Change: not supported
- Diagnostics : not supported

4   Profile definition

4.1   Master – Slave concept

The profile is based upon the master-slave principle. This means all communication is initiated by the master and a reply is generated by the slave (ComBox-P).
All buffers should be full length consistent.

4.2   Buffer structure

The Profile can be used for buffers with different length: 8,16,32 and 64 bytes. The buffer length has to be defined and initialised during downloading of the software inside the ComBox-P.

The DP buffer is split into 2 parts :
- header : 1 byte
- data section : n * data record (= 7 bytes) (Is programmeble in the combox (1,2,4,8))

n is defined by the total buffer length as follows

Buffer length	Number of data record (n)	Total used buffer length
8	1	8
16	2	15
32	4	29
64	8	57

Attention : not all functions allow more then 1 data record to be transferred. Basically read operations can be handled for several data records in 1 cycle, while write operations are only valid for a single data record at a time.

4.3   Header

The header is a 1 byte value that is bit encoded. The interpretation is different for Master->slave and Slave->Master communication.

4.3.1   Master to Slave

The header is split into 3 areas.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Sync.   Function   # parameters
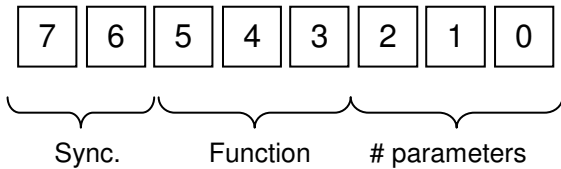
Synch. or "Synchronisation" bits can be used to synchronise master requests and slave answers. The slave will always reflect the same bit sequence in its answer (see Slave to Master header). This way an 'old' answer can be distinguished from a new one.

Functions that are supported for master to slave

Value	Function (Master-> Slave
0	No task
1	Request Parameter Value (read)
3	Alter Parameter Value (write) Note : only 1 parameter can be writing in 1 cycle, # parameters must be 1
2,4,5,6,7	Reserved

 # parameters : number of data records in the message

1	=	001
2	=	010
3	=	011
4	=	100
5	=	101
6	=	110
7	=	111
8	=	000

4.3.2   Slave to Master

The header is split into 3 areas.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Sync.   Function   error code
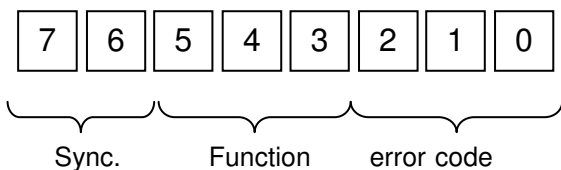
The following functions are supported for slave to master:

Value	Function (Master-> Slave
0	No task, or no data yet
2	Transmit Parameter Value (s)
7	Task not possible
1,3,4,5,6	Reserved

Synch. or "Synchronisation" bits will be set identical to the bits from the master-slave request.

Error Code :

Error Code	Explanation
0	No Error
1	Nr of Data Records are not Correct
2	Function is not correct
3	Number of Data Records for reprogramming not correct (Only one Data record).

4.4   Data Record

Each data record is 7 bytes long and contains the following info:
- Node Address : 1 bytes, CAN address of slave to connect to
- Parameter ID : 2 bytes, ID of the parameter to read/write Data : 4 bytes, containing actual data

4.4.1   Node Address

This is the Elektronikon MkIV CAN address : 1 to 30 (31 only used for default factory setting, should not be used in network).

Additional error info : bit 7 (highest bit) will be set to 1 in a <u>Slave to Master</u> Data Record, if this data record contains an error.

4.4.2   Profibus Parameter ID for Data Reading

4.4.2.1   Compressor connection

Function to be used : Read 01

NodeAddress	Profibus Parameters	Data 4 Bytes			
B1	**B2 B3**	**B4**	**B5**	**B6**	**B7**
7F	0000	Compressors Connection			

Parameter	**Bit**	
Compressor Connection	0	Compressor with Node ID 1 is found
	1	Compressor with Node ID 2 is found
	….	
	29	Compressor with Node ID 30 is found

4.4.2.2   Detailed General Compressor Condition

NodeAddress	Profibus Parameters (HEX)	Profibus Parameters (DEC)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
	190	0400	CS	CCM	CMS	COM
	191	0401	CS_MCC	ZH STATUS	GENERAL STATUS	
	192	0402	BOV actual position [%]	IGV actual position [%]	Surge Nr (S) [± 9999]	

Parameter	Bit	
General status	0	Pre – Warning
	1	General Warning
	2	General Shutdown-Warning
	3	General Shutdown
	4	General Service
	5	General Start Failure
	6	Emergency Stop
	7	Manual/Automatic (COS1)
	8	Local/Remote
	9	Timer Not Active/Active
	10	Pre-warning Service Running Hours
	11	Pre-warning Service Accumulated M3
AV4000 Status	0	Shutdown to surge
	1	Oil heater On
	2	Oil Pump On
	3	Manual valve control active
	4	Opening IGV limited due to high motor current
	5	Regulation Type (0 = constant pressure / 1 = auto-dual)
	6	Idling Timer (0 = disabled / 1 = enabled)

CCM (Compressor Controller Mode)	CCM2a	00 (hex)
	CCM2b	10
	CCM2e	40
	CCM3a	01
	CCM3b	11
	CCM3e	41
	CCM4a	02
	CCM4b	12
	CCM4c (Speed control)	22
	CCM4d (MCC)	32
	CCM4e	42
CMS (Compressor Mechanical State)	Stopped	01 bit 0
	Unloaded	02 bit 1
	Loaded	04 bit 2

Very Important Note !!!!!.

4.4.2.2.1   C.C.M.

2   Local Control (Keyboard)

         This mode has 2 variants
                   2a   local pressure control
                   2b   External Load/Unload control (Pressure Switch)
                   2e   4-20 mA external speed control

3   Remote Control (Digital)

         This mode has 3 variants
                   3a   local pressure control
                   3b   External Load/Unload control (Pressure Switch)
                   3e   4-20 mA external speed control

4   Remote Control (Communication remote)

         This mode has 5 variants
                   4a   local pressure control
                   4b   remote setpoint control (Control over CAN)
                   4c   remote speed control (Control over CAN)
                   4d   MCC control
                   4e   4-20 mA external speed control

4.4.2.2.2   Status for Fixed Speed , AQ Fixed Speed , ES002

STATE name	STATE Number	Description
A	1	Compressor Off
C	3	Motor Stopped
D	4	Motor Stopped
E	5	Automatically Unloaded
F	6	Automatically Unloaded
G	7	Automatically Loaded
H	8	Manually Unloaded
I	9	Programmed Stop
J	10	Programmed Stop
K	11	Programmed Stop
L	12	Programmed Stop
M	13	Programmed Stop
N	14	Shutdown
P	16	Compressor is Starting
Q	17	Compressor is Starting
R	18	Compressor is Starting
S	19	Manually Unloaded
T	20	Unload due to overpressure
V	22	Initializing

4.4.2.2.3   Status for MCC

STATE name	STATE Number	Description
A	1	Ready for Start
B	2	Central Control Regulating
C	3	Central Control Stopped
D	4	Start Impossible

4.4.2.2.4   Status for VSD , AQ VSD , PET VSD Booster , ZB VSD

STATE name	STATE Number	Description
A	1	**Compressor Off**
C	3	**Motor Stopped**
D	4	**Motor Stopped**
E	5	**Motor Started**
F	6	**Automatically Unloaded**
G	7	**Automatically Speed Control**
I	9	**Programmed Stop**
J	10	**Programmed Stop**
K	11	**Programmed Stop**
L	12	**Motor Stopped**
N	14	**Shutdown**
P	16	**Compressor is Starting**
Q	17	**Programmed Stop**
V	22	**Initializing**

4.4.2.2.5   Status for ZH Turbo

STATE name	STATE Number	Description
A	1	**Compressor Off**
C	3	**Motor Stopped**
D	4	**Motor Stopped**
E	5	**Motor Started**
F	6	**Automatically Unloaded**
G	7	**Automatically Loaded**
H	8	**Manually Unloaded**
I	9	**Programmed Stop**
J	10	**Programmed Stop**
K	11	**Programmed Stop**
L	12	**Programmed Stop**
N	14	**Shutdown**
P	16	**Compressor is Starting**
Q	17	**Programmed Stop**
R	18	**Compressor is Starting**
S	19	**Manually Unloaded**
U	21	**Automatic Unload due to Surge**
V	22	**Initializing**
X	24	**Minimum Load**
Y	25	**Full Load**
Z	26	**Minimum Minimum Load**

4.4.2.2.6   Status for SF (Multi)

STATE name	STATE Number	Description
A	1	**Compressor Off**
G	3	**Compressor Running**
V	22	**Initializing**

4.4.2.2.7   Status for PET Fixed Speed

STATE name	STATE Number	Description
A	1	**Compressor Off**
C	3	**Motor Stopped**
D	4	**Motor Stopped**
E	5	**Automatically Unloaded**
F	6	**Automatically Unloaded**
G	7	**Automatically loaded 100%**
H	8	**Manually Unloaded**
I	9	**Programmed Stop**
J	10	**Programmed Stop**
K	11	**Programmed Stop**
L	12	**Programmed Stop**
M	13	**Programmed Stop**
N	14	**Shutdown**
P	16	**Compressor is Starting**
Q	17	**Compressor is Starting**
R	18	**Compressor is Starting**
S	19	**Manually Unloaded**
T	20	**Unload due to overpressure**
V	22	**Initializing**

4.4.2.2.8   Status for BD Dryer (Stand alone) AIF

STATE name	STATE Number (DEC)	Description
A	0	Stopped
A1	1	Shifting1
A2	2	Pressure relief
A3	3	Start blower
A4	4	Heating Seq 1 (main on, regulating on)
A5	5	Heating Seq 1 (main on, regulating off)
A6	6	Heating Seq 1 (main off, regulating off)
A7	7	Cooling Seq1: blower on
A8	8	Cooling Seq2: blower off
A9	9	Heating Seq 2 (main on, regulating on)
A10	10	Heating Seq 2 (main on, regulating off)
A11	11	Heating Seq 2 (main off, regulating off)
A12	12	Cooling Seq3: cooling air valve open
A13	13	Pressure equalisation
A14	14	A:Split Flow Cool / B:Split Flow Ads
A15	15	Waiting
B1	16	Shifting
B2	17	Pressure relief
B3	18	Start blower
B4	19	Heating Seq 1 (main on, regulating on)
B5	20	Heating Seq 1 (main on, regulating off)
B6	21	Heating Seq 1 (main off, regulating off)
B7	22	Cooling Seq1: blower on
B8	23	Cooling Seq2: blower off
B9	24	Heating Seq 2 (main on, regulating on)
B10	25	Heating Seq 2 (main on, regulating off)
B11	26	Heating Seq 2 (main off, regulating off)
B12	27	Cooling Seq3: cooling air valve open
B13	28	Pressure equalization
B14	29	A:Split Flow Ads / B:Split Flow Cool.
B15	30	Waiting
V	31	Recovering from power failure / Init
N	32	Shutdown
A16	33	StartingReg1
A17	34	StartingReg2
B16	35	StartingReg1
B17	36	StartingReg2
A18	37	Shifting2
A19	38	OpenRegValve
B18	39	Shifting2
B19	40	OpenRegValve

4.4.2.2.9   Status for BD Dryer (Stand alone) AII

STATE name	STATE Number	Description
A	0	Stopped
A1	1	Shifting
A2	2	Pressure relief
A3	3	Start blower
A4	4	Heating Seq 1 (main on, regulating on)
A5	5	Heating Seq 1 (main on, regulating off)
A6	6	Heating Seq 1 (main off, regulating off)
A7	7	Cooling 1: blower on
A8	8	Cooling 2: blower off
A9	9	Heating Seq 2 (main on, regulating on)
A10	10	Heating Seq 2 (main on, regulating off)
A11	11	Heating Seq 2 (main off, regulating off)
A12	12	Cooling 3: cooling air valve open
A13	13	Pressure equalisation
A14	14	Split Flow Cool / Split Flow Ads
A15	15	Waiting
B1	16	Shifting
B2	17	Pressure relief
B3	18	Start blower
B4	19	Heating Seq 1 (main on, regulating on)
B5	20	Heating Seq 1 (main on, regulating off)
B6	21	Heating Seq 1 (main off, regulating off)
B7	22	Cooling 1: blower on
B8	23	Cooling 2: blower off
B9	24	Heating Seq 2 (main on, regulating on)
B10	25	Heating Seq 2 (main on, regulating off)
B11	26	Heating Seq 2 (main off, regulating off)
B12	27	Cooling 3: cooling air valve open
B13	28	Pressure equalisation
B14	29	Split Flow Cool / Split Flow Ads
B15	30	Waiting
N	31	Shutdown
V2	32	Recovering from power failure
V	33	INIT
X	-	Can be one of the states: A1…B15

4.4.2.2.10   Status for CD Dryer (Stand alone)

STATE name	STATE Number	Description
A	1	Dryer off
A0	2	Exhaust vessel A / Shifting
A1	3	Regenerating vessel A
A2	4	Pressurizing vessel A
B0	5	Exhaust vessel B / Shifting
B1	6	Regenerating vessel B
B2	7	Pressurizing vessel B
W	8	Purge saving
V	9	Power on, checking auto restart conditions (ARAVF)

4.4.2.2.11   Status for FD-Fixed Speed & FD-VSD Dryer (Stand alone)

STATE name	STATE Number	Description
A	1	Dryer off
C	3	Dryer stopped
E	5	Dryer starting
G	7	Dryer running
N	14	Dryer shutdown
P	16	Checking permissive start condition(s) (Dryer Starting)
V	22	Power on, checking auto restart conditions (ARAVF)

4.4.2.2.12   Status for MD-Fixed Speed Dryer (Stand alone)

STATE name	STATE Number	Description
A	1	Dryer off
N	14	Dryer shutdown
V	22	Power on, checking auto restart conditions (ARAVF)

4.4.3 Inputs & Outputs

4.4.3.1 Analogue Inputs – Sensors & Calculated

The Elektronikon MkIV supports up to 55 analogue sensor inputs and 10 additional analogue calculated (virtual) inputs. Each input has a 'value' and a 'status' register assigned.

The contents of these registers depend on the actual type of sensor that is connected. This can be different for every type of compressor. E.g. standard compressors may have 1 to 4 pressure inputs, 1 to 10 temperature inputs, up to 7 SPM inputs,…

Also, features and options may increment the number of sensors that are actually installed on your compressor.

Before using the modbus system it is therefore required to find out what sensors are really connected to your compressors. This can e.g. be done with the FDP program. This program has a function that lists the sensors + profibus registers for a selected compressor type (including features and options).

Once the list of sensors is known, the contents of the registers can be interpreted as described below.

4.4.3.2 ParameterID

4.4.3.2.1 Sensor Inputs

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	0000	0000	Analogue Input 1 – Value		Analogue Input 1 – Status	
	0001	0001	Analogue Input 2 – Value		Analogue Input 2 – Status	
	…..	…..				
	0035	0053	Analogue Input 54 – Value		Analogue Input 54 – Status	
	0036	0054	Analogue Input 55 – Value		Analogue Input 55 – Status	

4.4.3.2.2 Calculated (virtual) Inputs

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	0037	0055	Analogue Input 56 – Value		Analogue Input 56 – Status	
	…..	…..				
	0040	0064	Analogue Input 65 – Value		Analogue Input 65 – Status	

4.4.3.3 "Status" register Interpretation
Byte 6 **(B6)**   = 00
Byte 7 **(B7)**   = **Input Status**

The Input Status must be interpreted as **Binary data (bit coded)**.
Each part (bit) of the data (byte) is indicating a specific item that applies on the Input function. In the following table, an overview is given of all bits together with the corresponding meaning and interpretation.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function Description	Input Set/Not Set	Sensor Error	Permissive Start	Service	Shutdown	Shutdown Warning	Warning	Pre-Warning
Bit "1"	Set	Active	Active	Active	Active	Active	Active	Active
Bit "0"	Not Set	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active

4.4.3.4 "Value" register Interpretation

This depends on the type of inputs.

4.4.3.4.1 Pressure Input
The Pressure Input Value is a 2 byte integer, and contains the actual reading in mbar (0.001 bar)
For negative values, standard 2-complement notation is used.

Example: Value = 7040 decimal or 0x1B80 hexadecimal = 7.040 bar.
Value = -1000 decimal (2-complement) or 0xFC18 = -1.000 bar

For sensor error the value the value 32767 or 7FFF (hex) is returned.

On some high pressure compressors (with working pressures above 30 bar) a special Pressure Input can be defined that returns data in cBar (0.01 bar) in stead of mBar.

4.4.3.4.2 Temperature Input
The Temperature Input Value is a 2 byte integer, and contains the actual reading in 0.1°C
For negative values, standard 2-complement notation is used.

Example: Value = 855 decimal or 0x0357 hexadecimal = 85.5 °C
Value = -250 decimal (2-complement) or 0xFF06 = -25.0 °C

For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.4.3 Vibration Input
The Vibration Input Value is a 2 byte integer, and contains the actual reading in 0.01µm
For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.4.4 Level Input
The Level Input Value is a 2 byte integer, and contains the actual reading in 0.1mm
For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.4.5 Conductivity Input
The Conductivity Value is a 2 byte integer, and contains the actual reading in 1 µS/cm
For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.4.6 SPM Input
The SPM Input Value is a 2 byte register that must be seen as 2 x 1 byte.
- Byte 1 : carpet value (in dB)
- Byte 2 : peak value (in dB)

Example: Value = 0x1120 = > carpet value = 0x11, peak value = 0x20

For sensor error the value the value 0X7FFF (hex) is returned.
SPM values cannot be negative

4.4.3.4.7   Current Input

The Current Input Value is a 2 byte integer, and contains the actual reading in 0.1 A
For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.4.8   Speed Input

The Speed Input Value is a 2 byte integer, and contains the actual reading in 1 rpm
For sensor error the value the value 32767 or 7FFF (hex) is returned.

4.4.3.5 Special Alarms

The Elektronikon MkIV supports up to 32 special alarms
Before using the profibus system it is therefore required to find out which special alarms are activated.
This can e.g. be done with the FDP program. This program has a function that lists the special alarms + profibus registers for a selected compressor type .

Once the list special alarms is known, the contents of the registers can be interpreted as described below.

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
	0259	0600	Not used	Not used	Not used	Status
	…….	…….				
	0278	0631	Not used	Not used	Not used	Status

Parameter	Bit	
Status	0	Not Used
	1	Not Used
	2	Warning
	3	Not Used
	4	Not Used
	5	Not Used
	6	Shutdown
	7	Not Used

4.4.3.6   Digital (Voltage free contacts) Inputs

The Elektronikon MkIV supports up to 18 digital (voltage free) inputs. Each input has a 'value' and a 'status' register assigned. The contents of these registers is for digital inputs always the same, if the input is used.

Before using the profibus system it is therefore required to find out what inputs are used on your compressors. This can e.g. be done with the FDP program. This program has a function that lists the digital inputs + profibus registers for a selected compressor type (including features and options).

Once the list of inputs is known, the contents of the registers can be interpreted as described below.

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	00C8	0200	Digital Input 1 – Value		Digital Input 1 – Status	
	00C9	0201	Digital Input 2 – Value		Digital Input 2 – Status	
	…..	…..				
	00E8	0232	Digital Input 33 – Value		Digital Input 33 – Status	

4.4.3.7   "Status" register Interpretation

Byte 6 (**B6**)   = **00**
Byte 7 (**B7**)   = **Input Status**

The Input Status must be interpreted as **Binary data**.

Each part (bit) of the data (byte) is indicating a specific item that applies on the Input function. In the following table, an overview is given of all bits together with the corresponding meaning and interpretation.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function Description	Input Set/Not Set	Sensor Error	Permissive Start	Service	Shutdown	Shutdown Warning	Warning	Pre-Warning
Value "1"	Set	Active	Active	Active	Active	Not used	Active	Active
Value "0"	Not Set	Not Active	Not Active	Not Active	Not Active	Not used	Not Active	Not Active

4.4.3.8   "Value" register Interpretation

Value: 00   Digital input is **Open**
Value: 01   Digital input is **Closed**

4.4.3.9 Analogue Outputs (Only for Turbo)

The Elektronikon MkIV supports up to 2 analogue outputs.

4.4.3.10 Registers

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	02BC	0700	0		Analogue Output 1 -Value	
	02BD	0701	0		Analogue Output 2 -Value	

4.4.4   Counters

4.4.4.1   Compressor Counters

The Elektronikon MkIV supports up to 33 counters (32-bit counters). Each input as 2 x 16bit 'value' register assigned, to allow a 32-bit value to be read.

Before using the profibus system it is therefore required to find out what inputs are used on your compressors. This can e.g. be done with the FDP program. This program has a function that lists the dcounters inputs + profibus registers for a selected compressor type (including features and options).

Once the list of inputs is known, the contents of the registers can be interpreted as described below.

Function to be used : Read 01

Node Address	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	012D	0300	Running Hours			
	012E	0301	Loaded Hours			
	012F	0302	Motor Starts			
	0130	0303	Module Hours			
	0131	0304	Accumulated Volume			
	0132	0305	Load cycle			
	0133	0306	VSD 1-20% RPM			
	0134	0307	VSD 20-40% RPM			
	0135	0308	VSD 40-60% RPM			
	0136	0309	VSD 60-80% RPM			
	0137	0310	VSD 80-100% RPM			
	0138	0311	Not yet used			
	0139	0312	50 % loaded hours			
	013A	0313	Load relay 2			
	013B	0314	Counter application Specific			
	…..	…..	……..			
	014C	0332	Counter application Specific			

- yes, if VSD has unloading cycle (e.g. Z-VSD)

Interpretation of data in the registers

Example Running Hours

Running Hours → B4 B5 B6 B7

00 2C 93 45   → 2921285 sec → 811 hrs

An Example to calculate the VSD %Counters

Running Hours	**65** s
1 - 20%	41 s
20 - 40 %	13 s
40 - 60 %	3 s
60 - 80 %	1 s
80 - 100 %	7 s

1 -20%   41 s
20 - 40 %   13 s   --> 13*100/65 = 20   --> 20%   (round off downwards if the value is lower then xx,50 else round
40 - 60 %   3 s   -->   3*100/65 =   4,61   --> 5%   off upwards)
60 - 80 %   1 s   -->   1*100/65 = 1,53   --> 2%
80 - 100 %   7 s   -->   7*100/65 = 10,76   --> 11%
                                                         ----
                                                         40 %

100 % - 40 % = 60%
 1-20%   41 s   **60%**

4.4.4.2 Multi Compressor Controller Counters

The Elektronikon MkIV contains 4 counters (32-bit counters) to perform the MCC load balancing between up to 4 compressors. Each such counter as 2 x 16bit 'value' register assigned, to allow a 32-bit value to be read.
Only units where the MCC master function is active contain real data for this registers.

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes				
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**	
			W1		W2		Units
	01F4	0500	Compressor 1 counter				s
	01F5	0501	Compressor 2 counter				s
	01F6	0502	Compressor 3 counter				s
	01F7	0503	Compressor 4 counter				s

Data interpretation is the same as for the other counters

4.4.4.3 ES 6

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes				
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**	
			W1		W2		Units
	01F4	0500	Compressor 1 counter				s
	01F5	0501	Compressor 2 counter				s
	01F6	0502	Compressor 3 counter				s
	01F7	0503	Compressor 4 counter				s
	01F8	0504	Compressor 5 counter				s
	01F9	0505	Compressor 6 counter				s

Data interpretation is the same as for the other counters

4.4.5 Special

4.4.5.1 VSD motor data

The Elektronikon MkIV on VSD units contains some important data about the motor speed.This data can be read over the modbus system.

Function to be used : Read 01

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes				
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**	
			W1		**W2**		Units
	320	800	0000 (Not Used)		Required motor speed		rpm
	321	801	0000 (Not Used)		Actual motor speed motor 1		rpm
	322	802	0000 (Not Used)		Actual motor speed motor 2		rpm
	323	803	0000 (Not Used)		Actual motor speed motor 3		rpm

Each register contains a 16-bit value that is directly readable as the equivalent rpm.

4.4.6   ES 8 Data Readout

4.4.6.1   Analogue Inputs

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		W2	
	04B0	1200	MPL Number for Analogue Input 1		Analogue Input 1 – Value	
	04B1	1201	MPL Number for Analogue Input 2		Analogue Input 1 – Value 2	

Parameter	Value	Selections
MPL-number	0 ⇔ 32000	Unique reference number
Actual value	-32767 ⇔ 32767	Actual measurement in technical units

Remarks:
- Fixed relation between sub-indices and physical input (first analogue input = sub-index 1)
- ES 8 supports only 2 analogue inputs
- The MPL-number is unique and specifies the type of measurement and technical unit

Description	Type	MPL number
Net pressure	Pressure [mbar]	4501
Net pressure back-up	Pressure [mbar]	4502

- When an input is not used (not active, not exist) the MPL-number and value are 0.
- When the input measurement is in 'error', the value "7FFF" is returned.
- See also pressure input

4.4.6.2 Digital Inputs

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	04E2	1250	MPL Number for Digital Input 1		Status	Value
	…	…				
	04F1	1265	MPL Number for Digital Input 16		Status	Value

Parameter	Value	Selections
MPL-number	0 ⇔ 32000	Unique reference number
Status	0 ⇔ 1	0 = not used
		1 = active input
Actual value	0 ⇔ 1	Actual input status
		0=open / 1=closed

Remarks:
- Fixed relation between sub-indices and physical input (first digital input = sub-index 1)
- Maximum 16 digital inputs are supported by the ES 8

Description	MPL number
Local/Remote	4700
SPS selection 1	4701
SPS selection 2	4702
Motor status DL1	4703
Load status DL1	4704
Motor status DL2	4705
Load status DL2	4706
Motor status DL3	4707
Load status DL3	4708
Motor status DL4	4709
Load status DL4	4710
Motor status DL5	4711
Load status DL5	4712
Motor status DL6	4713
Load status DL6	4714

- The 4th input of the remote control DIOE is not used => Status in sub-index 4 will be 0

4.4.6.3 Digital Outputs

NodeAddress	Profibus Parameters	Data 4 Bytes			
B1	**B2 B3**	**B4**	**B5**	**B6**	**B7**
		W1		**W2**	
	1300	MPL Number for Digital Outnput 1		Status	Value
	1315	MPL Number for Digital Output 16		Status	Value

Parameter	Value	Selections
MPL-number	$0 \Leftrightarrow 32000$	Unique reference number
Status	$0 \Leftrightarrow 1$	0 = not used
		1 = active output
Actual value	$0 \Leftrightarrow 1$	Actual output status
		0=de-energized / 1=energized

Remarks:
- Fixed relation between sub-indices and physical input (first digital input = sub-index 1)
- Maximum 16 digital outputs are supported by the ES800

Description	MPL number
System Alarm	4800
Net Pressure Alarm	4801
Net Pressure Warning	4802
Local / Central Control	4803
Local / Remote DL1	4804
Load / Unload DL1	4805
Local / Remote DL2	4806
Load / Unload DL2	4807
Local / Remote DL3	4808
Load / Unload DL3	4809
Local / Remote DL4	4810
Load / Unload DL4	4811
Local / Remote DL5	4812
Load / Unload DL5	4813
Local / Remote DL6	4814
Load / Unload DL6	4815

4.4.6.4 ES 8 System Data

NodeAddress	Profibus Parameters	Data 4 Bytes			
B1	**B2 B3**	**B4**	**B5**	**B6**	**B7**
		W1		W2	
	1350	Regulation Control (SPS)	Active SS	Active Parameter Set	# Compressors
	1351	Not Used	Control Mode	ARAVF Status	System Info

Definitions:

Regulation control and Active SPS
    Value 1 = central stopped
    Value 2 = central regulating SPS1 active
    Value 4 = central regulating SPS2 active
    Value 8 = central regulating SPS3 active
    Value 16 = local control / no central regulation
    Value 32 = system alarm (must be reset)

Active Sequence Scheme: number from 1 to 8

Active Parameter set:
    Value 1 = parameter set 1 is used
    Value 2 = parameter set 2 is used
    Value 4 = parameter set 3 is used
    Value 8 = parameter set 4 is used
    Value 16 = parameter set 5 is used

connected compressors: number from 0 to 8

Control Mode: start/stop commands are only valid if coming from
        1 = local
        2 = digital remote
        4 = LAN remote

ARAVF status
        1 = not active
        2 = active
        4 = active (infinite)

System Information (bit coded data):
    Bit 00: Week timer active
    Bit 01: System stop enabled
    Bit 02: Pressure low alarm triggered
    Bit 03: Pressure low warning triggered
    Bit 04: Pressure high alarm triggered
    Bit 05: Pressure high warning triggered

4.4.7 ES 130 Data Readout

4.4.7.1 Analogue Inputs

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	04B0	1200	MPL Number for Analogue Input 1		Analogue Input 1 – Value	
	04C3	1219	MPL Number for Analogue Input 20		Analogue Input 20 – Value	

Parameter	Value	Selections
MPL-number	0 ⇔ 32000	Unique reference number
Actual value	-32767 ⇔ 32767	Actual measurement in technical units

Remarks:
- Fixed relation between sub-indices and physical input (first analogue input = sub-index 1)
- When an input is not used (not active, not exist) the MPL-number and value are 0.
- When the input measurement is in 'error', the value "7FFF" is returned.

4.4.7.2 Digital Inputs (Not Used)

NodeAddress	Profibus Parameters	Data 4 Bytes			
B1	**B2 B3**	**B4**	**B5**	**B6**	**B7**
		W1		**W2**	
	1250	MPL Number for Digital Input 1		Status	Value
	1265	MPL Number for Digital Input 16		Status	Value

Parameter	Value	Selections
MPL-number	0 ⇔32000	Unique reference number
Status	0 ⇔ 1	0 = not used
		1 = active input
Actual value	0 ⇔ 1	Actual input status
		0=open / 1=closed

4.4.7.3 Digital Outputs (Not Used)

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	0514	1300	MPL Number for Digital Output 1		Status	Value
	0523	1315	MPL Number for Digital Output 16		Status	Value

Parameter	Value	Selections
MPL-number	0 ⇔ 32000	Unique reference number
Status	0 ⇔ 1	0 = not used
		1 = active output
Actual value	0 ⇔ 1	Actual output status
		0=de-energized / 1=energized

Remarks:
- Fixed relation between sub-indices and physical input (first digital input = sub-index 1)
- Maximum 16 digital outputs are supported

4.4.7.4 ES 130 Status Data

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	B2 B3	B2 B3	B4	B5	B6	B7
			W1		W2	
	055A	1370	Status Display			
	055B	1371	Status Control			
	055C	1372	Display Commands			
	055D	1373	Not Applicable			
	055E	1374	Status Apply 1			

Definitions:

Status Display

Bit 01:   Local controle
Bit 02:   ES Controle
Bit 03:   Central Stop

Status Control

Bit 00:   Not Applicable
Bit 01:   Not Applicable
Bit 02:   Not Applicable
Bit 03:   Not Applicable
Bit 04:   Not Applicable
Bit 05:   SPS1 manual active
Bit 06:   SPS2 manual active
Bit 07:   SPS3 manual active
Bit 08:   Fixed(0)/Offset(1) Level (Warning/Shutdown)
Bt 09:   SPS manual(0)/auto(1)
Bit 10:   SPS0 auto active
Bit 11:   SPS1 auto active
Bit 12:   SPS2 auto active
Bit 13:   SPS3 auto active
Bit 14:   Not Applicable
Bit 15:   Not Applicable
Bit 16:   Not Applicable
Bit 17:   Not Applicable
Bit 18:   Not Applicable
Bit 19:   Not Applicable
Bit 20:   Not Applicable
Bit 21:   Not Applicable
Bit 22:   Energy Saving
Bit 23:   Capacity Group Management
Bit 24:   Forced Sequence
Bit 25:   Equal wear
Bit 26:   pressure deviation shutdown
Bit 27:   pressure deviation warning
Bit 28:   H pressure shutdown
Bit 29:   H pressure warning
Bit 30:   L pressure warning
Bit 31:   L pressure shutdown

Display Commands

Bit 01:   Local controle
Bit 02:   ES Controle
Bit 03:   Central Stop

4.4.8   ES 6 Data Readout

4.4.8.1   System Data

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		W2	
	0546	1350	Regulation Control (SPS)	Active SS	Not Applicable	# Compressors
	0547	1351	Not Applicable	Control Mode	ARAVF Status	System Info

Definitions:

Regulation control

　　Value 1 = central stopped

　　Value 2 = central regulating

　　Value 16 = local control

　　Value 32 = system alarm (must be reset)

Active Sequence Scheme: number from 1 to 6

connected compressors: number from 0 to 1

Control Mode: start/stop commands are only valid if coming from

　　　　　　0 = local

　　　　　　1 = digital remote

　　　　　　2 = LAN remote

ARAVF status

　　　　　　1 = not active

　　　　　　2 = active

　　　　　　4 = active (infinite)

System Information (bit coded data):

　　Bit 00: Week timer active

　　Bit 01: System stop enabled

　　Bit 02: Not Applicable

　　Bit 03: Pressure low warning triggered

　　Bit 04: Not Applicable

　　Bit 05: Pressure high warning triggered

4.5   Profibus parameters for change

4.5.1   Load/Unload Pressure Band change

It is possible to change the operating pressure band inside the Elektronikon MkIV, or to switch between the two available pressure bands. These registers are only valid for Load/Unload compressors

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	0424	1060	0000 (Not Used)		Pressure Band Selection	
	0425	1061	0000 (Not Used)		Loading pressure band 1	
	0426	1062	0000 (Not Used)		Unloading Pressure band 1	
	0427	1063	0000 (Not Used)		Loading pressure band 2	
	0428	1064	0000 (Not Used)		Unloading Pressure band 2	

Pressure Band Selection : 1 = band 1, 2 = band 2

Attention : when writing values the following relations should be maintained :
Loading pressure < unloading pressure (per band)
Loading pressure should not be below the minimum setting that was factory defined.
Unloading pressure should not be above the maximum setting that was factory defined.

Values not fulfilling this will be refused.

4.5.2   VSD Setpoint change

It is possible to change the operating set point inside the Elektronikon MkIV, or to switch between the two available pressure set points. These registers are only valid for VSD compressors

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	041A	1050	0000 (Not Used)		Setpoint Selection	
	041B	1051	0000 (Not Used)		Setpoint 1	
	041C	1052	0000 (Not Used)		Setpoint 2	

Setpoint Selection : 1 = Setpoint 1, 2 = Setpoint 2

The set point must be within the limits that are factory defined for your machine type.

Values not fulfilling this will be refused by the MKIV.

4.5.3   MCC Pressure Band change

In Elektronikons where the MCC master function is active it is possible to change the operating pressure band for this master, or to switch between the two available pressure bands.

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
				W1		**W2**
	0438	1080	0000 (Not Used)		MCC Pressure Band Selection	
	0439	1081	0000 (Not Used)		MCC Loading pressure band 1	
	043A	1082	0000 (Not Used		MCC Unloading Pressure band 1	
	043B	1083	0000 (Not Used		MCC Loading pressure band 2	
	043C	1084	0000 (Not Used)		MCC Unloading Pressure band 2	

Pressure Band Selection : 0 = band 1, 1 = band 2

Attention : when writing values the following relations should be maintained :

Loading pressure < unloading pressure (per band)

Values not fulfilling this will be refused by the MKIV.

4.5.4   ES 6 Pressure Band change

In Elektronikons where the ES 6 master function is active it is possible to change the operating pressure band for this master, or to switch between the two available pressure bands.

Functions to be used :
For reading : Read Holding Register (03)
For writing :Preset Single Register (06)

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
				W1		**W2**
	0438	1080	0000 (Not Used)		ES6 Pressure Band Selection	
	0439	1081	0000 (Not Used)		ES6 Loading pressure band 1	
	043A	1082	0000 (Not Used		ES6 Unloading Pressure band 1	
	043B	1083	0000 (Not Used		ES6 Loading pressure band 2	
	043C	1084	0000 (Not Used)		ES6 Unloading Pressure band 2	
	043D	1085	0000 (Not Used)		ES6 Priority Scheme selection	

Pressure Band Selection : 0 = band 1, 1 = band 2
Priority Scheme selection 0 = Priority Scheme 1 , 1 = Priority Scheme 2

Attention : when writing values the following relations should be maintained :

Loading pressure < unloading pressure (per band)

Values not fulfilling this will be refused by the MKIV.

4.5.5   PET L/U Regulation Band Change

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Hex)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
				W1	**W2**	
	442	1090	0000 (Not Used)		Pressure Band Selection	
	443	1091	0000 (Not Used)		Regulation Method	
	444	1092	0000 (Not Used)		100 % Loading Pressure band1	
	445	1093	0000 (Not Used		50 % Loading Pressure band1	
	446	1094	0000 (Not Used		100 % Unloading Pressure band1	
	447	1095	0000 (Not Used		50 % Unloading Pressure band1	
	448	1096	0000 (Not Used		100 % Loading Pressure band2	
	449	1097	0000 (Not Used		50 % Loading Pressure band2	
	44A	1098	0000 (Not Used		100 % Unloading Pressure band2	
	44B	1099	0000 (Not Used)		50 % Unloading Pressure band2	

Pressure Band Selection : 1 = band 1, 2 = band 2

Regulation Method :   1   0 - 100 %
                           2   0 - 50 %
                           3   0 – 50 – 100 %

The values must be within the limits that are factory defined for your machine type.

Values not fulfilling this will be refused by the MKIV.

4.5.6   ZH Turbo Regulation Setpoint and Band Change

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	456	1110	0000 (Not Used)		Setpoint selection	
	457	1111	0000 (Not Used)		Setpoint 1	
	458	1112	0000 (Not Used)		Load offset 1	
	459	1113	0000 (Not Used		Unload offset1	
	45A	1114	0000 (Not Used		Setpoint 1	
	45B	1115	0000 (Not Used		Load offset 1	
	45C	1116	0000 (Not Used		Unload offset1	

Setpoint Selection : 1 = Setpoint 1, 2 = Setpoint 2

The values must be within the limits that are factory defined for your machine type.

Values not fulfilling this will be refused by the MKIV.

4.5.7   ES 130 SPS

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	0578	1400	0000 (Not Used)		SPS1 High Shutdown	
	0579	1401	0000 (Not Used)		SPS1 High Warning	
	057A	1402	0000 (Not Used)		SPS1 Maximum	
	057B	1403	0000 (Not Used)		SPS1 Unload	
	057C	1404	0000 (Not Used)		SPS1 Setpoint	
	057D	1405	0000 (Not Used)		SPS1 Load	
	057E	1406	0000 (Not Used)		SPS1 Minimum	
	057F	1407	0000 (Not Used)		SPS1 Low Warning	
	0580	1408	0000 (Not Used)		SPS1 Low Shutdown	
	0581	1409	0000 (Not Used)		SPS2 High Shutdown	
	0582	1410	0000 (Not Used)		SPS2 High Warning	
	0583	1411	0000 (Not Used)		SPS2 Maximum	
	0584	1412	0000 (Not Used)		SPS2 Unload	
	0585	1413	0000 (Not Used)		SPS2 Setpoint	
	0586	1414	0000 (Not Used)		SPS2 Load	
	0587	1415	0000 (Not Used)		SPS2 Minimum	
	0588	1416	0000 (Not Used)		SPS2 Low Warning	
	0589	1417	0000 (Not Used)		SPS2 Low Shutdown	
	058A	1418	0000 (Not Used)		SPS3 High Shutdown	
	058B	1419	0000 (Not Used)		SPS3 High Warning	
	058C	1420	0000 (Not Used)		SPS3 Maximum	
	058D	1421	0000 (Not Used)		SPS3 Unload	
	058E	1422	0000 (Not Used)		SPS3 Setpoint	
	058F	1423	0000 (Not Used)		SPS3 Load	
	0590	1424	0000 (Not Used)		SPS3 Minimum	
	0591	1425	0000 (Not Used)		SPS3 Low Warning	
	0592	1426	0000 (Not Used)		SPS3 Low Shutdown	

4.5.8   ES 130 Isolate/Integrate Compressor

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	05AA	1450	0000 (Not Used)		Command to compressor 1	
		1452	0000 (Not Used)		Command to compressor 2	
		…..	0000 (Not Used)		…..	
	05E5	1509	0000 (Not Used)		Command to compressor 60	

Parameter	Value	
Command to compressor	1	Isolate
	2	Integrate

4.6 Profibus parameters for remote control

4.6.1 Control Commands

4.6.1.1 Compressor Control Mode Selection

The Elektronikon MkIV has a number of control modes that define the behaviour of a compressor in relation to external inputs (pressure reading, start/stop commands,…).
Each mode has a main type (= number 1 to 4), and a sub-type (a,b,c,..). The number of sub-types is different for each main type.

When Profibus has to be used to control a compressor the main type ust be set to 4 (=remote control over communication line). This has to be done through the display, select "LAN Control". By default the compressor will then enter the "4a" mode.

Through Profibus it is now possible to activate the other sub-types.

Functions to be used :
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters	Data 4 Bytes			
B1	**B2 B3**	**B4**	**B5**	**B6**	**B7**
		00	00	00	Value

Profibus Parameters (Hex)	Profibus Parameters (Dec)	Value to write	Description	Accepted in mode
07D1	2001	1	Switch from 4a or 4c to 4b	4a – 4c
		2	Switch from 4b or 4c to 4a	4b
		3	Switch from 4a or 4b to 4c	4a – 4b

Note
Mode 4a : remote control of start/stop but pressure control is done by the controller
Mode 4b : remote control of start/stop and pressure control is done from remote (Supervisory control) (also for VSD →
setpoint control and Turbo)
Mode 4c : remote control of start/stop with external speed (only vsd) → speed control)

	Switch from 4a to 4b	Switch from 4b to 4a
Fixed Speed	X	X
VSD	X	X
VSD Throttle Valve	X	X
AQ Fixed Speed	X	X
AQ VSD	X	X
ZH Turbo	X	X
PET Fixed Speed	X	X
PET VSD	X	X
WCO Fixed Speed	X	X
WCO VSD	X	X
SF (Multi)		
BD Dryer (AII)		
FD VSD Dryer		
MD Dryer		
ES002		

	Switch from 4a to 4c	Switch from 4c to 4a
Fixed Speed		
VSD	X	X
VSD Throttle Valve	X	X
AQ Fixed Speed		
AQ VSD	X	X
ZH Turbo		
PET Fixed Speed		
PET VSD	X	X
WCO Fixed Speed		
WCO VSD	X	X
SF (Multi)		
BD Dryer (AII)		
FD VSD Dryer		
MD Dryer		
ES002		

	Switch from 4b to 4c	Switch from 4c to 4b
Fixed Speed		
VSD	X	X
VSD Throttle Valve	X	X
AQ Fixed Speed		
AQ VSD	X	X
ZH Turbo		
PET Fixed Speed		
PET VSD	X	X
WCO Fixed Speed		
WCO VSD	X	X
SF (Multi)		
BD Dryer (AII)		
FD VSD Dryer		
MD Dryer		
ES002		

4.6.1.2 Compressor Commands

The commands that are described here are only available in the defined Compressor Control Modes.
Carefully consult the control concept of the compressors before using them.

Functions to be used :
For writing :Command or reprogramming 03

Profibus address (Hex)	Profibus address (Dec)	Value to write	Command	Accepted in mode
07D0	2000	1	Start	4a / 4b
		2	Stop	4a / 4b
		3	Load	4a / 4b
		4	Unload	4b (in 4a = Manual unload)
		5	MCC Start System	4a / 4d
		6	MCC Stop System	4d
		7	MCC Local	4d
		8	50 % Load (PET L/U Booster)	4b
		9	Not used	
		10	Start water-cooling pump (PET L/U or VSD Booster + PETPACK functionality is active)	4b
		11	Stop water-cooling pump (PET L/U or VSD Booster + PETPACK functionality is active)	4b
07D3	2003	1	Reset Shutdown	In all Modes
		2	Reset Start Failures	In all Modes
		8	System Reset ES4i	
07D4	2004 (ES8)+(ES130)	1	System Stop	LAN control & Stop enabled
	(ES8)+(ES130)	2	SPS1	LAN control
	(ES8)+(ES130)	3	SPS2	LAN control
	(ES8)+(ES130)	4	SPS3	LAN control
	(ES8)+(ES130)	5	System to local	LAN control
	(ES8)+(ES130)	6	System Reset	LAN control
07D5	2005 (ES8)	1	Switch to Sequence Scheme 1	LAN control
		2	Switch to Sequence Scheme 2	LAN control
		3	Switch to Sequence Scheme 3	LAN control
		4	Switch to Sequence Scheme 4	LAN control
		5	Switch to Sequence Scheme 5	LAN control
		6	Switch to Sequence Scheme 6	LAN control
		7	Switch to Sequence Scheme 7	LAN control
		8	Switch to Sequence Scheme 8	LAN control
07D6	2006 (ES130)	1	Energy Saving	LAN control
		2	Capacity Group Management	LAN control
		3	Forced Sequence	LAN control
		4	Equal wear	LAN control
07D7	2007 (ES130)	1	Reset Changes SPS	Always
		2	Apply Changes SPS	Always

	Start Command	Stop Command	Load Command	Unload Command
Fixed Speed	X	X	X	X
VSD	X	X		
VSD Throttle Valve	X	X		
AQ Fixed Speed	X	X	X	X
AQ VSD	X	X		
ZH Turbo	X	X	X	X
PET Fixed Speed	X	X	X	X
PET VSD	X	X		
WCO Fixed Speed	X	X	X	X
WCO VSD	X	X		
SF (Multi)	X	X		
BD Dryer (AII)	X	X		
CD Dryer	X	X		
FD VSD Dryer	X	X		
MD Dryer	X	X		
ES002				

4.6.2   VSD – external setpoint/speed control

On VSD units extended external control is possible whereby either the main motor speed of the pressure set point is directly controlled from remote over Profibus.
This can be done with the following Profibus parameters.

Functions to be used :
For reading : Read 01
For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
	042E	1070	0000 (Not Used)		External Setpoint	
	042F	1071	0000 (Not Used)		External Speed	

4.6.3   Reset Initial Settings (Analogue , Digital , Counter Inputs)

Functions to be used :

For writing :Command or reprogramming 03

NodeAddress	Profibus Parameters (Hex)	Profibus Parameters (Dec)	Data 4 Bytes			
B1	**B2 B3**	**B2 B3**	**B4**	**B5**	**B6**	**B7**
			W1		**W2**	
Existing Node	0834	2100	0000 (Not Used)		0000 (Not Used)	

4.7 Error Code for Data Record

Node Address	Parameter ID	Data
B1	B2 B3	B4 …. **B7**

When the highest bit of the Node Address is Set to 1, then there is an error in the Data Record.
The Error Code will be find in the Data of the Data Record (**B7**).

Error Code	Explanation
1	Node Address Not Found
2	Profibus Parameter Not Exist
3	MCC Not Found
4	Command Not Exist
5	Data For Compressor is Not Valid (Check Cable)
6	Command not accepted because previous command not yet executed.
7	Reprogramming not accepted because previous reprogramming not yet executed.

5 Profibus examples

5.1   Setup

GSD for 16 bytes input/output
NR. Of data records in ComBox-P = 2

5.2   Header Byte for Data Read-out

Sync bits + Function 01 (Read)

Nr of data Records	1	2
Sync bits		
00	**09**	**0A**
01	**49**	**4A**
10	**89**	**8A**
11	**C9**	**CA**

CA (HEX)   **11001010** (Bit)

	Sync Bits	**Function Bits**	**Parameters Bits**
CA	**11**	**001**	**010**

Function Bits	**001**	**Request Parameter Value**
Parameters Bits	**010**	**Nr. of Data Records = 2**

5.3   Header Byte for Commands or Reprogramming

Sync bits + Function 03 (Program)

Nr of data Records	1
Sync bits	
00	**19**
01	**59**
10	**99**
11	**D9**

49 (HEX)   **01011001** (Bit)

	Sync Bits	**Function Bits**	**Parameters Bits**
59	**11**	**011**	**001**

Function Bits	**011**	**Parameter Value (write)**
Parameters Bits	**010**	**Nr. of Data Records = 1**

5.4 Example Of Data Readout

Nr of data records 2

Analogue input 1 (Profibus adrdress 00) from compressor + Status data (profibus address 400) from compressor 2
4A 01 00 00 00 00 00 00 02 01 90 00 00 00 00

For the next question the synchronisation bits must be different from previous Data request and Command and Reprogramming
Analogue input 2 (Profibus address 0001) from compressor + Status data (profibus address 401) from compressor 2
8A 01 00 01 00 00 00 00 02 01 91 00 00 00 00

For the next question the synchronisation bits must be different from previous Data request and Command and Reprogramming
Only Analogue input 3(Profibus address 0002)

C9 01 00 02 00 00 00 00 00 00 00 00 00 00 00

5.5 Example Of Command

For the next Command the synchronisation bits must be different from previous Data request and Command and Reprogramming
Start command (Profibus address 2000 value 1 (Start Command))
19 01 07 D0 00 00 00 01 00 00 00 00 00 00 00

5.6 Example Of Reprogramming

For the next Reprogramming the synchronisation bits must be different from previous Data request and Command and Reprogramming

Reprogramming (reprogramming Pressure Band (Profibusaddress 1090 Pressure Band 2)
59 01 04 42 00 00 00 02 00 00 00 00 00 00 00

5.7 Example Data Error Code

Only Analogue input 3(Profibus address 0002)

89 01 00 02 00 00 00 00 00 00 00 00 00 00 00

Answer : 90 **81** 00 02 00 00 00 **05** 00 00 00 00 00 00 00 00

When the highest bit of the Node Address is Set to 1, then there is an error in the Data Record.

Error Code	Explanation
1	Node Address Not Found
2	Profibus Parameter Not Exist
3	MCC Not Found
4	Command Not Exist
5	**Data For Compressor is Not Valid (Check Cable or Power)**
6	Command not accepted because previous command not yet executed.
7	Reprogramming not accepted because previous reprogramming not yet executed.

5.8 Special Remarks

1. Do not start with Sync. Bits 00
2. Between two commands or two reprogrammings there must be minimum 500 ms or more , otherwise you can get error code 6 or 7
3. For each date request and command and reprogramming , you must use other synchronisation bits.
   Data request then command (you must use other synchronisation bits).

6 GSD file example

This GSD Example is for 2 data records (16 bytes input/output)

```
#Profibus_DP
Vendor_Name = "Atlas Copco"
Model_Name = "Profi2Can"
Revision = "0.00"
Ident_Number = 0x0008
Protocol_Ident = 0
Station_Type = 0
FMS_supp = 0
Hardware_Release = "A01"
Software_Release = "Z01"
9.6_supp = 1
19.2_supp = 1
93.75_supp = 1
187.5_supp = 1
500_supp = 1
1.5M_supp = 1
3M_supp=1
6M_supp=1
12M_supp=1
MaxTsdr_9.6 = 60
MaxTsdr_19.2 = 60
MaxTsdr_93.75 = 60
MaxTsdr_187.5 = 60
MaxTsdr_500 = 100
MaxTsdr_1.5M = 150
MaxTsdr_3M=250
MaxTsdr_6M=450
MaxTsdr_12M=800
Redundancy = 0
Repeater_Ctrl_Sig = 2
24V_Pins = 0

;--Slave Values -----

Freeze_Mode_supp = 1
Sync_Mode_supp = 1
Auto_Baud_supp = 1
Set_Slave_Add_supp = 0
User_Prm_Data_Len = 0
Min_Slave_Intervall = 20
Modular_Station = 1
Max_Module = 32
Max_Input_Len = 32
Max_Output_Len = 32
Max_Data_Len = 64

; Module Layout

Module = "16 bytes input" 0x1F
EndModule
Module = "16 bytes output" 0x2F
EndModule
```

6.1   Changing GSD File

6.1.1   1 Data Record

Module Layout

Module = "8 bytes input" 0x17
EndModule
Module = "8 bytes output" 0x27
EndModule

6.1.2   2 Data Records

Module Layout

Module = "16 bytes input" 0x1F
EndModule
Module = "16 bytes output" 0x2F
EndModule

6.1.3   4 Data Records

Module Layout

Module = "32 bytes input" 0x40 , 0x9F
EndModule
Module = "32 bytes output" 0x80 , 0x9F
EndModule

6.1.4   8 Data Records

Module Layout

Module = "64 bytes input" 0x40 , 0xBF
EndModule
Module = "64 bytes output" 0x80 , 0xBF
EndModule

;--Slave Values -----

Max_Input_Len = 64
Max_Output_Len = 64
Max_Data_Len = 128

6.2   Configuration Example