Protronic 100/500/550

Digitric 500

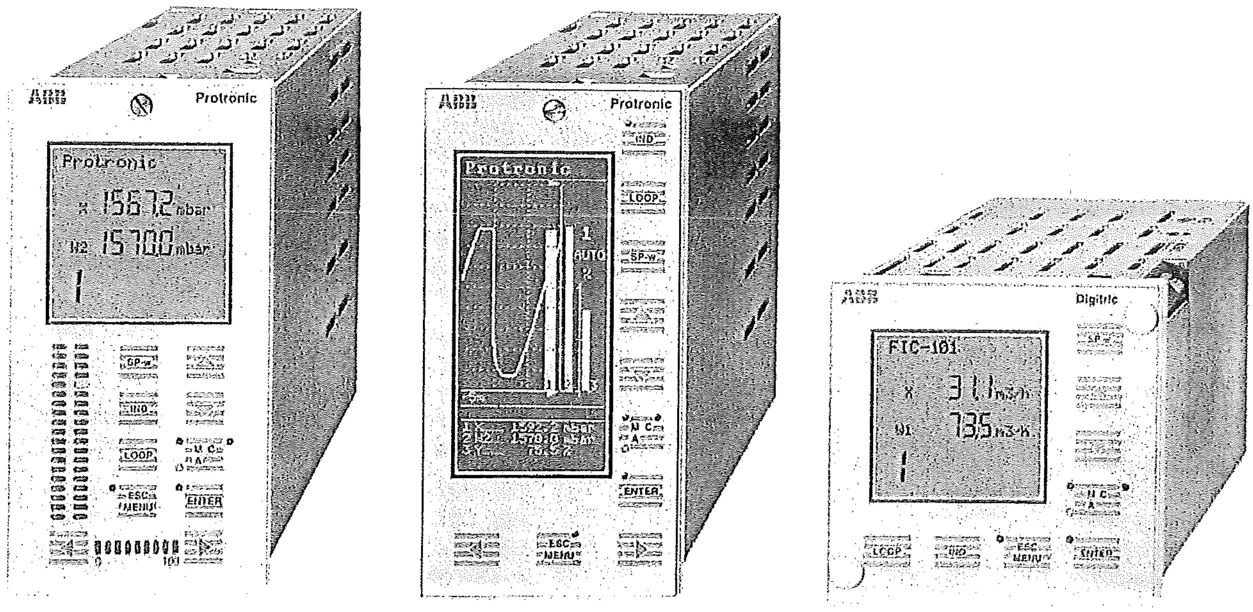
Controllers for
process engineering
Controllers for industry

PROFIBUS-DP interface and
module

Manual

42/62-50050 EN

Rev. 02



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Important instructions for your safety! Read and observe!

Safe and proper operation of the device requires proper transportation and storage, installation and commissioning by qualified personnel, proper use and careful maintenance. -

Only qualified personnel who are familiar with the installation, commissioning, operation and maintenance of similar devices are authorized to work on the device.-

Observe
- the present operating instructions,
- the warnings and cautions attached to the device-

- the relevant safety regulations and standards for the installation and operation of electrical systems and -
- the regulations and directives pertaining to explosion protection. -

The regulations, standards and directives referred to in these operating instructions are applicable in Germany. When using the device outside the German jurisdiction, the relevant regulations, standards and directives applicable in the country where the device is used must be observed.--

The device has been designed and tested in accordance with DIN VDE 0411 Part 1 "Safety Requirements for Electronic Measuring Apparatus" and has been supplied in a safe condition.- The present operating instructions contain warnings marked accordingly which must be followed by the user to retain the device in a safe condition and to ensure safe operation. Otherwise, persons may be injured or the device itself or other devices or installations may be damaged or fail. -

If you should need information which is not contained in the present operating instructions please contact our service department.

Additional Documentation

DIN 19245 Part 3 or EN 50170

These standards contain information about how to design the transmission medium, and about the protocol and how it works on the bus system. -

Writing Conventions

In the documentation related to PROFIBUS-DP numbers are usually written in hexadecimal format. In the following text, all numbers in hexadecimal format start with "0x". - The number of digits to the right of this code indicates the number of used bits (bytes).-

Example:

Decimal	Hexadecimal (8-bit)	Hexadecimal (16-bit)
37	0x25	0x0025
180	0xB4	0x00B4
7000	-	0x1B58

Application and Brief Description

The PROFIBUS-DP module for controllers improves and speeds up the data exchange with distributed process stations or operator and visualization stations. -- The PROFIBUS variant PROFIBUS-DP is used as the protocol. --

Usually, the data transmission to and from distributed devices is cyclical. -A central control unit ("master") reads the input information from the stations on the bus ("slaves") and writes back the output information to the respective slaves. --

In process automation, also non-cyclic events/operations (e.g. setpoint or mode changes) occur. - PROFIBUS-DP in its original form is not designed for handling these actions. This manual, however, contains a description of how to achieve acyclic transmission using the PROFIBUS-DP protocol. -

Contrary to former bus technologies, PROFIBUS also protects the bus system from troubles resulting from stations with invalid parameters or wrong configuration. It is also possible to disable or switch off a station without interrupting the high-speed data transmission. --

The following description provides all information needed for commissioning controllers as PROFIBUS-DP slaves. --

Installing and Commissioning

1. Scope of Delivery

- 1 "PROFIBUS-DP Slave" module
- 1 contact panel for the cable shield, for all controller types
- 2 shield clamps
- Cable straps
- 1 7-pin bus connector

Optionally available:
- Bus termination adapter

Note
With PROFIBUS-DP all device features are documented in a device data sheet or a device database file and are then made available to the user. -
The device database files - also referred to as "GSD files" - have a standardized structure, contents and code. As a result, engineering equipment and software packages from different vendors can be used for device engineering.-
The device database file provided for all device data is called:-

EBHB9651.GSD

⚠1 Warning

These files are editable text files. Do not edit/modify. If you should edit the GSD file, we will not accept any liability for proper functioning of the PROFIBUS-DP module.

2. Technical Data

Environmental capabilities

Operating temperature
0...55 °C

Mechanical capabilities
to DIN IEC 68 Part 2-6 and Part 2-27

Shock
30g / 18 ms
Vibration
2g / 0.15 mm / 5...150 Hz

Electromagnetic compatibility
to EEC directive 89/336 for EMC

RFI suppression
to EN 50081-1 (residential area)
EMI/RFI shielding
to EN 50082-2 (industrial area)

Transmission rate

The PROFIBUS-DP module supports all transmission rates conforming to the standards up to a maximum of 1.5 MBit/s (see device database file). -

3. Installing the Module

The PROFIBUS-DP module can be plugged in any slot of the device. Note that each device can be provided with one module, only.
As it is possible that an RS-232 or RS-485 module is used in parallel, requiring slot 2 (e.g. with Protronic 500) or slot 4 (e.g. with Digitric 500), it is recommended to avoid using these slots for the PROFIBUS-DP module. --

Refer to the installation instructions of the individual controllers for module installation details. -

4. Connecting the Module

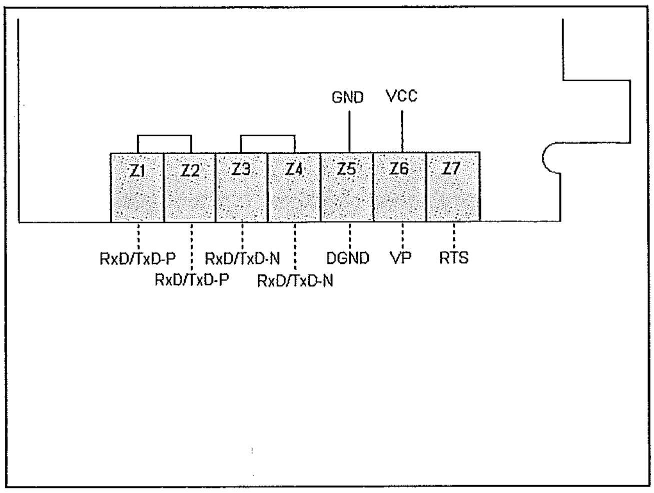


Figure 1 Module pin assignment
Z-19190

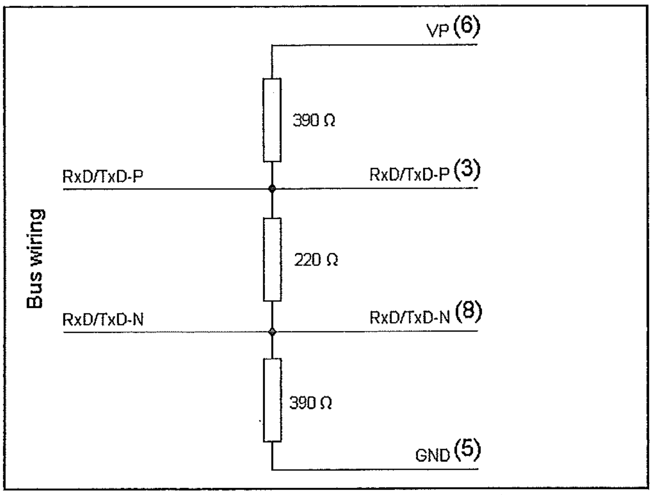


Figure 2 Wiring the termination resistors (cable type A)
Z-19188 (No.): PROFIBUS-DP with 9-pin Sub-D bus connector.

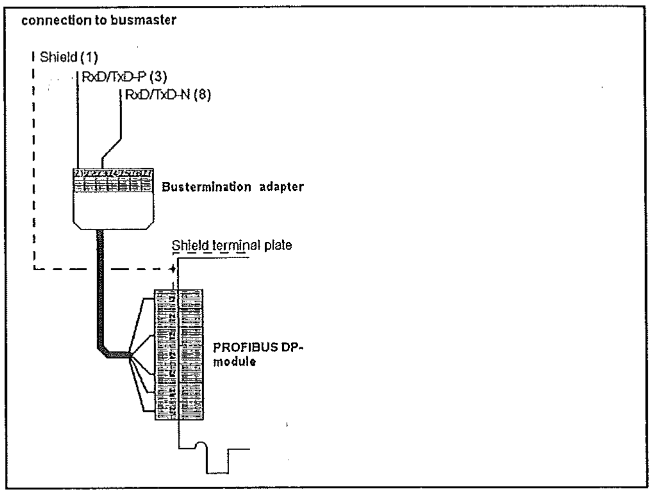


Figure 3 Wiring the bus termination adapter
Z-19187

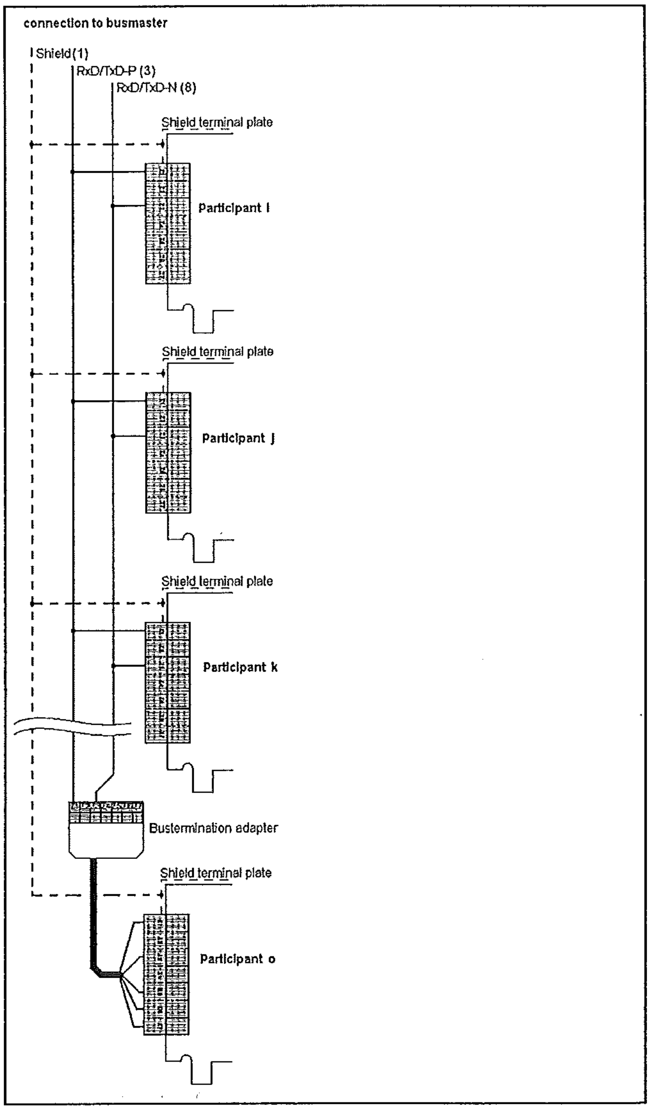


Figure 4 Wiring a station
Z-19189

Module pin assignment
(see Figure 1)

The PROFIBUS-DP module has a 7-pin connector plug for connection to the bus system (wire-bound transmission):-

Pin	Signal description
Z1	RxD/TxD-P (wire 1)
Z2	RxD/TxD-P (wire 1)
Z3	RxD/TxD-N (wire 2)
Z4	RxD/TxD-N (wire 2)
Z5	DGND
Z6	VP
Z7	RTS (via 390 Ω)

Pins Z1 and Z2 are connected to each other on the module, as well as pins Z3 and Z4. The RTS signal present on pin Z7 is a TTL signal.

Wiring
(see Figures 1 to 5)

The entire wiring of a PROFIBUS-DP system is based on the RS-485 transmission technique with a shielded twisted pair cable.- Therefore, all regulations stated in DIN 19 245 Part 3 Section 3 are applicable. -
DIN 19 245 recommends to use cable type A in a line structure.All transmission rates and cable lengths specified in this standard usually refer to cable type A.-

Wiring the bus stations

A maximum of 32 bus stations (at least one master and up to 31 slaves) can be combined in one bus segment. -

The possible cable lengths specified for PROFIBUS-DP depend upon the transmission rate and apply to bus links of cable type A in a bus segment, provided that these are equipped with a proper bus termination (see description below).-
Maximum bus segment length (for wire-bound transmission) without repeater.- When using FO cables for connection, the manufacturer specifications are valid, which usually allow to cover longer distances: -

Cable length	Max. transmission rate	Comment
1200 m	≤ 93.75 kBaud	
1000 m	187.5 kBaud	
400 m	500 kBaud	
200 m	1.5 MBaud	
100 m	3...12 MBaud	not supported by the controllers-

The bus stations must be wired in such a way that any of them can be removed from the bus without impairing the data traffic on the bus or even interrupting it.Do not apply the bus wires directly to pins Z1 and Z3 and then establish a connection to the next station using pins Z2 and Z4. Instead, feed the signals to the devices via stub lines. Stub lines to the individual stations should have a max. length of 6.6 m (with cable type A).-

Wiring the termination resistors / bus termination adapter

The module is not equipped with a bus termination. However, such a termination may be necessary to avoid mismatch between the cable termination and the characteristic impedance. In this case, a separate bus termination must be provided at the bus segment ends (master and last slave in the line structure, see Figures 2 and 4). --

It is also possible to terminate the bus with the optional bus termination adapter (see Figure 3). --
When using controllers as bus stations, the termination resistors must be connected via the separate bus termination adapter.- The adapter must be connected into the line between the device and the bus cables.- On the adapter's 7-pin screw terminal block the signals of pins Z1 (RxD / TxD-P), Z3 (RxD / TxD-N)), Z5 (DGND) and Z7 (RTS) are available, like on the module.The signals of pins Z2 (RxD / TxD-P), Z4 (RxD / TxD-N) and Z6 (VP) are not available, since the device with the bus terminators is equivalent with the last device in a bus segment and, therefore, does not need these signals.-
On the master station side, the termination resistors are usually integrated in the respective adapters. Please refer to the respective manuals for information on how to activate these resistors.-
What is stated above about error-free operation is also valid for the bus termination.- As a rule, the network should always be opened behind the bus termination adapter, i.e. directly at the PROFIBUS-DP module. -When the device is not powered for any reason, it can no longer be ensured that the DGND and VP signals are fed into the bus termination resistors or that the connection between the bus termination resistors and these signals is maintained. As a result, the communication may be affected in this case. - --Error-free data transfer cannot be ensured, then.-

Cable shield

The cable shield of the bus cables must be connected to the controller housing via the contact panel and the shield clamps delivered with the module.- -Otherwise, the specified EMI/RFI shielding and RFI suppression capabilities of the - PROFIBUS-DP interface cannot be ensured.-
For details about how to connect the cable shield using the contact panel and shield clamps please refer to the respective installation instructions of the individual controllers. --

RS-485 Repeaters

If more than 32 stations are connected to the bus, the signals on the bus have to be amplified by RS-485 repeaters. -

Note that one repeater is needed for every 31 stations (master plus slaves), since the RS-485 repeater itself is to be considered as a bus station as well.

Every section up to the first repeater or between two repeaters is called a bus segment. -

Repeaters are also required if a bus segment needed for the respective application cannot be realized using the possible cable lengths (given by the baud rate). - Refer to the RS-485 repeater documentation for the possible cable lengths.- The max. number of RS-485 repeaters that can be connected in series is also specified in these manuals. -

Since RS-485 repeaters are usually the first or last station in a bus network, they must be provided with the respective termination resistors to terminate the bus properly.

Station address

The station address of the device, i.e. of a DP slave on a communication bus, is entered in the controller list configuration under Device/Communication/Functional block 30/DP address/Inquiry 06.-- Any number between 1 and 125 is a valid entry. Automatic address assignment through the master is not supported.- This inquiry can only be selected with the device firmware revisions for library 3.5.0. The other inquiries in functional block 30 are used for setting up the communication via the RS-232 and RS-485 interface modules.

Additional recommendations related to installation and configuration

During the commissioning phase it may become necessary to increase the storage areas for the input and output data due to additional variables. Therefore, it is recommended to reserve a bigger area already when making the slave-specific configuration. Then it is only necessary to change the slave-specific parameter settings.

It is not always possible to write on the variable indices while the device is working. When the device is in configuration mode (menu level 2) in the menu system, the index can be written, but the PROFIBUS-DP module does not transmit the value to the device.-

Lateral Communication

If an optional RS-232 or RS-485 interface module has been installed in the controller, lateral communication programmable within the free configuration can be run in parallel with PROFIBUS-DP communication. - The necessary communication parameters have to be set by answering the inquiries of functional block 30 in the device configuration, dedicated to lateral communication.

Lateral communication has been configured in such a way that simultaneous writing on variables via lateral communication and PROFIBUS-DP communication is not possible. ---Therefore, no special attention has to be paid to a possible interlocking of these two functions. -

MODBUS Communication

If an optional RS-232 or RS-485 interface module has been installed in the controller, MODBUS communication can be run in parallel with communication via the PROFIBUS-DP interface. --
The necessary communication parameters have to be set by answering the inquiries of functional block 30 in the device configuration, dedicated to MODBUS communication.--
Since simultaneous write access via MODBUS communication and PROFIBUS-DP communication to variables or online parameters of the devices is possible, the last processed command enters its value. ---- None of the two communications has priority over the other. --

In case of cyclic write access to variables via PROFIBUS-DP, write access via MODBUS communication to the same variable has no permanent effect. --
It is recommended to avoid cyclic write access to online parameters, since this would cause various write actions to the nonvolatile flash memory. --- After around 100,000 write actions this will lead to malfunctions of the flash EPROM. --

Operation

Description

Every PROFIBUS-DP slave type must have an individual identification number (ID number). -- The PROFIBUS-DP master needs this ID number to identify the connected device type. - Before starting cyclic data transmission, the PROFIBUS-DP master compares the device ID number with the default number in the engineering data. -- Data transmission is only started if the proper device types with the correct station addresses have been connected to the bus, and if the parameter and configuration data from the slave have been checked and are correct. --- This ensures a good protection against engineering errors. -

The same ID number is valid for the controllers, and is assigned to them in factory.- As a result, the PROFIBUS-DP module can be used in all devices.

The device database files (GSD files) contain a description for the support of the basic PROFIBUS-DP services, and information about the size of the input and output data blocks transmitted via the bus. - These data blocks are defined in the GSD files as modules for communication with the controllers. -

Modular Slave

The device database file contains data that describe the so-called modules. - This module description is no description of the optional input/output modules that can be added to the individual devices at a later time. ---

Instead, it contains information about the storage areas of different sizes for the input and output data. --These storage areas are referred to as modules. - Configuration data can be created from these modules as a part of the bus configuration, communicating to the relevant slave the number of cyclic data bytes or words (2 bytes) it will receive from the master, or the number of cyclic data bytes or words which the master expects to receive from the slave.- - Up to 16 modules for input and output definition can be stored in a slave-specific configuration.- The PROFIBUS-DP master configuration tool prevents that this maximum value is exceeded.

Important Information about Services

Freeze and Sync services are supported, as specified in the GSD file. -

The PROFIBUS-DP module for the controllers supports the "Auto_Baud_Supp" service for automatic adjustment of the transmission rate on the bus. PROFIBUS-DP does not require any transmission rate adjustment in the device configuration. -

Since no automatic station address assignment takes place during operation, the address must be defined in the device configuration.

The "AUTO_CLEAR" function usually realized for PROFIBUS-DP slaves is not supported. As a result, the output values retain their value when the communication is interrupted, and are not reset to 0. Usually, the digital and analog outputs retain their values as well, depending on the device configuration.

Cyclic Operation

Usually, PROFIBUS-DP communication is cyclical.- This means that the data is transmitted between the master and the slave in a special, permanently repeated rhythm.- The number of bytes transmitted from the master to the slave (output data) or from the slave to the master (input data) is the same for every transfer action. - However, the volume of the input data is different from that of the output data.
This situation can only be changed through reconfiguration, or through redefinition of parameters. --
When PROFIBUS-DP communication was defined, a maximum size was fixed for the data blocks that can be transmitted from the master to the slave and vice versa. - The exact number of bytes that can be transferred in the respective direction is specified in the device database file (GSD file) of every device designed for PROFIBUS-DP communication.- With controllers, usually 224 input data bytes and 64 output data bytes can be transmitted. -

However, up to 2000 different data are available for reading/writing with most of these devices. Therefore, the user must define in an application-specific description the data that are to be communicated in the input or output data. ---

This application-specific description is written into the slave-specific parameter data set ("User_Prm_Data") of the master. - Up to 224 bytes can be entered here. The first 4 bytes are already predefined. This means that 220 bytes are available for definition.

Usually, indices in 16-bit integer format are used to define which data is to be read/written cyclically.---- Please refer to section "Addressing the Data" for details about index assignment to the variables and online parameters in both decimal and hexadecimal format.--- Up to 110 variables and online parameters can be defined in the 220 available bytes.-

Reading Values (Cyclically)

The description for cyclic reading of one or more values can be defined in the "User_Prm_Data" data of the respective slave through several subsequent indices. - The order is very important. The input data are transmitted from the master to the slave in the same order in which they are defined in the "User_Prm_Data".---

Example

The measuring values from the four analog inputs of the first module are to be read cyclically in the order .AE11, .AE12, .AE13, and .AE14.

Variable	Data type	PROFIBUS-DP index (decimal)
.AE11	REAL	5
.AE12	REAL	7
.AE13	REAL	9
.AE14	REAL	11

From this results for "User_Prm_Data":

User_Prm_Data = .., .., .., .., 5, 7, 9, 11 End_User_Prm_Data

The 4 bytes at the beginning of the slave-specific parameter data (.., .., .., ..,) are predefined and must not be used for defining variables. - Refer to section "Peculiarities of "User_Prm_Data"" for details. -

As a result, the slave will return 16 bytes to the master. - The first 4 bytes contain the value of variable .AE11 in REAL format. - The second 4 bytes contain the value of variable .AE12 in REAL format, and so on. -

This example assumes that the necessary configuration information for the bus system has been provided without errors in the slave-specific data of the master, and has been accepted by the addressed slave. ---

Refer to section "Addressing the Data" for the assignment of the indices to the variables and online parameters.-

Writing Values (Cyclically)

The description for cyclic writing of one or more values can be defined in the "User_Prm_Data" of the respective slave through several subsequent indices. --- Contrary to cyclic reading, the indices must be entered with a negative sign in the "User_Prm_Data". -- The order is very important. The output data are transmitted from the master to the slave in the same order in which they are defined in the "User_Prm_Data".

Example

The computer output variables of the first two control loops are to be written cyclically, in the order .L1_YCOMPUTER and .L2_YCOMPUTER. -

Variable	Data type	PROFIBUS-DP index (decimal)
.L1_YCOMPUTER	REAL	255
.L2_YCOMPUTER	REAL	405

From this results for "User_Prm_Data":

User_Prm_Data = .., .., .., .., -255, -405 End_User_Prm_Data

The 4 bytes at the beginning of the slave-specific parameter data (.., .., .., ..,) are predefined and must not be used for defining variables. - Refer to section "Peculiarities of "User_Prm_Data"" for details. -

To ensure error-free operation, the master must transmit 8 bytes to the addressed slave. In the first 4 bytes the value for the .L1_YCOMPUTER variable must be entered (in REAL format), and in the second 4 bytes the value for the .L2_YCOMPUTER variable (REAL format as well). -

This example assumes that the necessary configuration information for the bus system has been provided without errors in the slave-specific data of the master, and has been accepted by the addressed slave. -

Refer to section "Addressing the Data" for details about the assignment of indices to the variables and online parameters, and for the directives for creating negative indices in hexadecimal format. --

Reading and Writing Values Cyclically

If values are both read and written cyclically, it is also possible to specify a mixture of these two methods in the "User_Prm_Data" of the master. -
Positive and negative indices can then be defined in the required order. -
What is important for cyclic reading, i.e. for the data transfer from the slave to the master, is only the order of the positive indices. -
What is important for cyclic writing, i.e. for the data transfer from the master to the slave, is only the order of the negative indices.

Examples
The variables already known from the previous examples art to be read and written, i.e. the variables .AE11 to .AE14 are to be read, and the variables .L1_YCOMPUTER and .L2_YCOMPUTER are to be written. --

Variable	Data type	Direction	PROFIBUS-DP index (decimal)
.AE11	REAL	Read from slave	5
.AE12	REAL	Read from slave	7
.AE13	REAL	Read from slave	9
.AE14	REAL	Read from slave	11
.L1_YCOMPUTER	REAL	Write to slave 255	
.L2_YCOMPUTER	REAL	Write to slave 405	

Possible "User_Prm_Data":
- User_Prm_Data = .., .., .., .., 5, 7, 9, 11, -255, -405 End_User_Prm_Data
- User_Prm_Data = .., .., .., .., -255, -405, 5, 7, 9, 11 End_User_Prm_Data
- User_Prm_Data = .., .., .., .., 5, 7, -255, -405, 9, 11 End_User_Prm_Data
- User_Prm_Data = .., .., .., .., 5, -255, 7, 9, 11, -405 End_User_Prm_Data etc.

There are 15 possible combinations for reading/writing these values in the specified order. -
The 4 bytes at the beginning of the slave-specific parameter data (.., .., .., ..,) are predefined and must not be used for defining variables. - For details refer to section "Peculiarities of "User_Prm_Data"". -
It is, however, recommended to use only one of the first two variants which do not contain a mixture of negative and positive indices and, thus, are clearer. --

Peculiarities of "User_Prm_Data"

The "User_Prm_Data" already mentioned in the examples for reading and writing values contain 4 predefined bytes at the beginning of the file. -

These four bytes have the following meaning:

The 1st, 2nd and 3rd byte must be preset to 0x00.
The 4th. byte defines the order of bytes for cyclic data transfer, i.e. the order in which the bytes are to be transmitted on the bus. - Refer to section "Numerical Formats and Displays" for details.It is important that the setting is made for all dates, not specifically for a special date.This byte should be set to 0 or 0x00 or 255 or 0xFF. If other values are entered, a parameter data error will be indicated.
Some DP configuration tools require that the maximum number of data bytes is set in the "User_Prm_Data".---- Usually, less than 110 variables have to be read or written. To avoid a complicated parameter definition for all unused variables in this case, the procedure can be simplified by entering the integer value 0x0000 (or 2 bytes 0x00, 0x00) after the last used index. - When this value is recognized as and index by the PROFIBUS-DP module, the following part of "User_Prm_ Data" will be ignored.

This means that the two examples shown below have the same result in terms of cyclic data transfer for "User_Prm_Data":
User_Prm_Data = .., .., .., .., 5, 7, 9, 11 End_User_Prm_Data

User_Prm_Data = .., .., .., .., 5, 7, 9, 11, 0, 47, End_User_Prm_Data
Configuration tools of this kind always transfer the max. possible data quantity at the time when parameters are defined. However, while cyclic data transfer is in progress only the absolutely required data is transmitted to keep the bus load as low as possible for the respective station. -

Acyclic Operation

The descriptions above refer to cyclic, i.e. continuously repeated data transfer. If, however, values like control parameters or setpoints have to be written sporadically for these devices, the cyclic system can no longer be used. - Therefore, PROFIBUS-DP offers for these devices an interface for acyclic operation.
This kind of operation permits both acyclic writing and acyclic reading of data. -

First of all you have to find out if the used PROFIBUS-DP master already supports the standardized services of Version 1 called PROFIBUS-DP V1.-- Otherwise, you can also use the realization without PROFIBUS-DP V1 which is described later in this manual.

Realization with PROFIBUS-DP V1

The standardized version of PROFIBUS-DP V1 provides 2 services for acyclic communication, called READ (for acyclic reading) and WRITE (for acyclic writing). These services are available for PROFIBUS-DP masters of Class 1 and Class 2.
Data addressing for communication is mainly based on two description values: **Slot** and **index**. Every pollable controller value, variable or online parameter can be addressed in a unique way through slot and index.

Refer to section "Tables" for realizations without PROFIBUS-DP V1 that are already in use. You can find there an ID for every addressable value. - This 16-bit index is also called a variable index. The addresses for PROFIBUS-DP V1 services are based on this variable index. For this purpose, the 16-bit variable index (read hexadecimal) is split up in its high and low part. For DP V1 addressing the high part is used as slot, and the low part as index..

Example

Variable .L3_R1

16-bit variable index	0x023B(hexadecimal format)	
Slot	0x02	(hexadecimal format)
Index	0x3B	(hexadecimal format)

This method is also applicable for the used variable indices of online parameters, for which the variable index can be calculated on the basis of special information (see section "Addressing the Data"). -
When using this variable index, take care not to use the values 255 or -0xFF, as they are predefined values. Since there are values within the existing variable indices which may assume the value 255 or 0xFF, these values must be changed. No problem will arise if slot is set to one of these values (255 or 0xFF). If however, a value of 0xFF results for index, use value 0x00 for index and increase slot by 0x80.

Example

Variable .L3_T1_STEUER

16-bit variable index	0x01FF(hexadecimal format)	
Slot	0x81	(0x01 + 0x80; hexadecimal format)
Index	0x00	(0xFF → 0x00; hexadecimal format)

Description of the acyclic READ service in accordance with DP V1

The acyclic READ service hands over 3 parameters: -

Request telegram:

Parameter name	Value range	Data type	Description
Slot	0 - 254	Byte	Slot for addressing the variable to read
Index	0 - 254	Byte	Index for addressing the variable to read
Length	1 - 240	Byte	Number of bytes to read

Table 1

Positive response telegram:

Parameter name	Value range	Data type	Description
Length	1 - 240	Byte	Number of read bytes. If the required length for the data is inferior to the length in the request, the smaller value is entered here. If the required length for the data is superior to the length in the request, the value of the request is entered here. ---
Data	......	Byte	Bytes for required size. The number of bytes corresponds exactly to the specified length. -

Table 2

Negative response telegram:

Parameter name	Value range	Data type	Description	
Error ID	......	Byte	Provides information about the sending protocol system (here PROFIBUS-DP V1). - The only valid value that may appear here is 128.-	
Error code 1	......	Byte	Error details. ID:-	
			0xA0	Variable defined by slot and index is unknown. -
			0xA8	Controller firmware does not support PROFIBUS-DP V1.-
			0xB0	Service not yet usable.-
			0xC0	Too many requests at the same time. Current request will not be processed. - -
Error code 2	......	Byte	Not used	

Table 3

Description of the acyclic WRITE service in accordance with DP V1

The acyclic write service always derives the slot and index from the hexadecimal 16-bit variable index for reading. - Four parameters are handed over in the request telegram:

Request telegram:

Parameter name	Value range	Data type	Description
Slot	0 - 254	Byte	Slot for addressing the variable to write.
Index	0 - 254	Byte	Index for addressing the variable to write.
Length	1 - 240	Byte	Number of bytes to write-
Data	......	Bytes	Bytes for value of variable to write. It is impossible to specify more bytes than defined by length.-

Table 4

Positive response telegram:

Parameter name	Value range	Data type	Description
Length	1 - 240	Byte	Number of written bytes. If the required length for the data is inferior than the requested length, the negative value is entered here. If the required length for the data is superior to the the requested length, the requested length is entered here. --

Table 5

Negative response telegram:

Parameter name	Value range	Data type	Description	
Error ID	......	Byte	Provides information about the sending protocol system (here PROFIBUS-DP V1).- The only valid value that may appear here is 128.-	
Error code 1	......	Byte	Error details. ID: -	
			0xA1	Variable defined by slot and index is unknown.-
			0xA8	Controller firmware does not support PROFIBUS-DP V1.-
			0xB0	Service not yet usable.-
			0xC0	Too many requests at the same time. Current request will not be processed. --
Error code 2	......	Byte	Not used	

Table 6

Realization without PROFIBUS-DP V1

Acyclic data transmission without PROFIBUS-DP V1 is based on the usage of data blocks in the input and output data cyclically transmitted to a specific slave. -- These data blocks are used as "envelopes" in which data can be entered if required and from which results can be read. Since these data blocks are transmitted cyclically, this method slightly increases the transmission time, but this increase is negligible.

There are modules in the device database file that are tailored to this application - like for the slave-specific configuration data for cyclic operation. -- A total of 2 modules is available for acyclic transmission. One module is dedicated to writing, and one to reading of data.

Data blocks in the input and output data are reserved for the read and write services, regardless which of the services is selected. - The service is entered in the output data and transmitted to the slave. The result is transmitted to the master in the input data.

Up to 4 acyclic services can be used in parallel for every controller. To achieve this, the necessary modules must be entered together in the slave-specific configuration data. --

Description of the Write Service

The write service requires 8 bytes in the output data for the request, and 6 bytes in the input data for the response. This structure is defined directly in the device database file as a module. A write command is entered in the output data by setting the bytes. The response is then returned in the input data. --

Output data (request) telegram:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		Word 1					
Service =0x10	Polling number-	Variable index		1 to 4 data bytes			
Service =0x10	Polling number-	Variable index Lowbyte -	Variable index Highbyte -	1 to 4 data bytes			

Table 7

Input data (response) telegram

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
		Word 1			
Service =0x10	Polling number -	Variable index		Status	Error
Service =0x10	Polling number -	Variable index Lowbyte -	Variable index Highbyte -	Status	Error

Table 8

The response becomes valid at the time when the polling number has the same value in the response telegram as in the request telegram. --

Description of the individual entries:

Entry	Data type	Description
Service	Byte	ID for write service (Index = 0x10). This value can be entered once before the first write job.- It is not necessary to make an entry for every write service to start. --
Poll. number	Byte	When this value is changed, the write job will be executed. - As long as this value remains unchanged, the write job is not executed any longer. -- Value 0 is permissible.- It is useful to activate a write job by incrementing the value by 1. - A one byte overflow from 0xFF to 0x00 is not a problem.
Variable index	16-bit integer	Index of variables that are to be written.- Refer to section "Addressing the Data" for a list of possible indices. Only use the same positive variable indices for acyclic writing as for cyclic reading. -

Entry	Data type	Description
Variable index Lowbyte	Byte	The low byte of the 16-bit integer value for the variable index. --- In the attached variable index list these are the 2 right digits of the hexadecimal number. ---- Only necessary when the master system does not allow to define a 16-bit integer. --
Variable index Highbyte	Byte	The high byte of the 16-bit integer value for the variable index. -- In the attached variable index list these are the 2 digits to the right of 0x....... in hexadecimal format. Only necessary when the master system does not allow to define 16-bit integers. ------
1 to 4 Data bytes	4 bytes	Data block for REAL, DINT, TIME, INT and BOOLean data
Status	Byte	0x01 is delivered as the status when the job has been carried out without errors. - The error field contains the value 0x00. Otherwise, 0x00 is delivered as the status. In this case, the error cause can be derived from the error field.
Error	Byte	Outputs information about the occurred error, when the status field has the value 0x00. Error codes: 0x00 No error. 0x40 Unknown service entered in the service field. -- 0x20 Unknown index entered in the variable index field. -

Example

The value 65.0 is to be written acyclically to the manually adjustable output value of the second control loop. The necessary variable .L2_YHAND has the variable index 0x015B. With byte-wise definition, 0x5B, 0x01 (low byte before high byte) must be used. -

The REAL number 65.0 in byte format is: 0x00, 0x00, 0x82, 0x42.

This is valid if 0xFF has been entered in the DP parameter definition as the 4th. byte. -

The byte value to be specified as the polling number must be different from the byte value used before.

Assumption:

So far the byte value of the polling number was 8.

In this case, the following values have to be entered in the request bytes:

Request:
0x10, 0x08, 0x5B, 0x01, 0x..., 0x..., 0x..., 0x...

(Variable index in bytes , "0x..." means any value for the four data bytes)

Then the value 65.0 must be entered in the data bytes:
0x10, 0x8B, 0x5B, 0x01, 0x00, 0x00, 0x82, 0x42

(Variable index in bytes)

When all bytes have been entered (except for the second byte), the polling number can be incremented:
0x10, **0x09**, 0x5B, 0x01, 0x00, 0x00, 0x82, 0x42
(Variable index in bytes)

Response (provided that no errors have occurred):
0x10, 0x08, 0x5B, 0x01, 0x01, 0x00

(Variable index in bytes)

The modified polling number is returned only when the acyclic write job has been fully processed by the DP slave. --
0x10, **0x09**, 0x5B, 0x01, 0x010, 0x00

(Variable index in bytes)

Since the polling number (2nd byte) is then identical with the transmitted polling number, the result can be evaluated. -
If the status (5th byte) is correct, the value 0x01 (as indicated here) and the value 0x00 (6th. byte, error) are returned. - Then the next variable index can be written, or a new value can be entered for the same variable index.

If the index is wrong (e.g. if the connected controller does not yet know the index), a static diagnostic information is additionally transmitted to the DP master. ---The DP master then has to poll the diagnostic function until the DP slave does no longer transmit this diagnostic data. ---

Description of the Read Service

The read service requires 4 bytes in the output data for the request, and 10 bytes in the input data for the response. This structure is defined directly in the device database file as a module. A read job is written in the output data, the result is returned in the input data. --

Output data (request) telegram:

Byte 0	Byte 1	Byte 2	Byte 3
		Word 1	
Service =0x20	Polling number -	Variable index	
Service =0x20	Polling number -	Variable index Lowbyte -	Variable index Highbyte -

Table 9

Input data (response) telegram

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
		Word 1							
Service =0x20	Polling No. -	Variable index		Status	Error	1 to 4 data bytes			
Service =0x20	Polling No. -	Var. index Lowbyte --	Var. index Highbyte--	Status	Error	1 to 4 data bytes			

Table 10

The response becomes valid at the time when the polling number has the same value in the response telegram as in the request telegram.-

Description of the individual entries:

Entry	Data type	Description
Service	Byte	ID for the read service (Index = 0x20)
Polling number	Byte	When this value is changed, the read job will be executed. - As long as this value remains unchanged, the read job is not executed any longer.- Value 0 is permissible.- It is useful to activate a read job by incrementing the value by 1. - A one byte overflow from 0xFF to 0x00 is not a problem. -
Variable index	16-bit integer	Index of the variable that is to be read. - Refer to section "Addressing the Data" for a list of possible indices.
Variable index Lowbyte	Byte	The low byte of the 16-bit integer value for the variable index.-- In the attached variable index list these are the 2 right digits of the hexadecimal number.---- Only necessary when the master system does not allow to define a 16-bit integer. --
Variable index Highbyte	Byte	The high byte of the 16-bit integer value for the variable index. -- In the attached variable index list these are the 2 digits to the right of 0x....... in the hexadecimal number format. Only necessary when the master system does not allow to define 16-bit integers.------
Status	Byte	0x01 is delivered as the status when the job has been carried out without errors. - The error field contains the value 0x00. Otherwise, 0x00 is delivered as the status. In this case, the error cause can be derived from the error field.
Error	Byte	Outputs information about the occurred error, when the status field has the value 0x00. Error codes: 0x00 No error occurred 0x40Unknown service entered in the service field. -- 0x20Unknown index entered in the variable index field.-
1 to 4 Data bytes	4 bytes	Data block for REAL, DINT, TIME, INT and BOOLean data.

Example

The output value of the 3rd control loop is to be read acyclically. The required variable .L3_PID_Y_OUT has the variable index 0x0367. The byte value for the polling number must be different from the byte value used before. A REAL number is read as the requested value. -

Request:

0x20, byte value, 0x0367 (variable index as 16-bit integer)

0x20, byte value, 0x67, 0x03 (variable index in bytes)

Response (if processed without errors):
0x20, byte value, 0x0367, 0x01, 0x00 , 4 bytes for value

(Variable index as 16-bit integer)
0x20, byte value, 0x67, 0x03, 0x01, 0x00, 4 bytes for value

(Variable index in bytes)
The 4 bytes for the values are to be interpreted in accordance with section "Numerical Formats and Displays". --

Configuration Instructions

A description which specifies the size of the required storage areas is required for error-free cyclic data transmission to/from the devices, in addition to the slave-specific parameter information. -- This slave-specific description is called PROFIBUS configuration. - -

When the slave is changed over to cyclic data transmission, the data blocks defined in the slave-specific configuration are transmitted as input and output data bytes on the bus. ---This means that the size of the data blocks is an important factor - besides the transmission rate - which determines how often data exchange with all bus stations is performed. - The smaller the transported data packages are, the more often a station can be contacted. -

The data blocks are built up from the modules specified in the device database file (GSD file). These modules are split up in three groups: - The first group contains all modules defining the size of the input data blocks, the second group is made up of all modules specifying the size of the output data blocks, and the third groups comprises the modules for acyclic transmission. -

It is recommended to calculate the required sizes for the input and the output data from the data types of the cyclically read or written variables when combining the necessary modules. -- -

The configuration data can then be derived from the individual modules. - It is recommended to calculate a reserve for the input data, since it may turn out in the commissioning phase that more data is needed from the connected devices. -

The modules for the input and output data blocks can be combined in an arbitrary order when selecting them using the device database and a configuration tool. -- Therefore, it is recommended to select first all modules for the input data block and then all modules for the output data block, to obtain an open structure. The configuration can then be extended at a later time by simply adding modules. The configuration tool used determines the efforts required for this task.

If the configuration consists of an arbitrary combination of input and output data blocks, the DP master and the DP slaves form input and output groups of them. - ----- From this result the sizes of the individual input or output data blocks.

When the configured data blocks are bigger than defined by the indices in the parameter definitions for a slave, the connected device will nevertheless accept this constellation. -

However, data blocks that are too small and insufficient for data exchange with the configured variables are considered as erroneous and will be rejected. -- In the commissioning phase, no cyclic data transmission will be performed. Instead, the PROFIBUS-DP master receives the respective diagnostic data. No change-over to cyclic data transmission takes place. ----

Example

Cyclic transmission between a master and a slave is to be established. For this purpose, 26 bytes are transmitted from a slave to a master (input data), and the master cyclically returns 1 byte to the slave (output data). The necessary storage areas for one read service and one write service are reserved. -----

The sizes of 26 bytes (input data) and 1 byte (output data) would have resulted from the slave-specific parameter definitions. -

In reality, 48 bytes are given for the input data (can be extended at a later time by setting the parameters accordingly), and 2 bytes are given for the output data.

These data blocks are written in the configuration, in the order read service, write service, output data, and input data. -

Usually, a byte-by-byte definition is used for slave-specific PROFIBUS-DP configuration data. --

A possible configuration would be:

Cfg_Data = 0xC1, 0x03, 0x09, 0x03, 0xC1, 0x07, 0x05, 0x01, 0x60, 0x5F, 0x57

This configuration is built up from the following modules:

Module	Data bytes
Read service	0xC1, 0x03, 0x09, 0x03 Gives a storage area of 4 bytes for the acyclic read service as request and 10 bytes as response.
Write service	0xC1, 0x07, 0x05, 0x01 Gives a storage area of 8 bytes for the acyclic write service as a request and 6 bytes as the response.
Output data	0x60 Gives a storage area of 1 word or 2 bytes .
Input data	0x5F, 0x57 Gives a storage area of 16 words or 32 bytes (0x5F) and an area of 8 words or 16 bytes (0x57). Since the PROFIBUS-DP module sums up these parts, a total of 48 bytes is available for input data. ----

Refer to DIN 19245 Part 3 for the exact meaning and function of the individual bytes.

Peculiarities

Some configuration tools for PROFIBUS-DP systems do not permit the definition of slave-specific configuration data as described above. -- Systems using such tools derive the necessary configuration data from the data of the connected controllers. - The respective setting for the size of the input and output data blocks is read from the configuration in this case. -- -

When the DP master integrates a new station in the DP communication system, first the configuration data is read, then the slave-specific parameters are defined, and then the configuration data is returned to the station. ---

The size of these data blocks must be set in the controller configuration for this. This is achieved by answering configuration inquiries 7 and 8 in configuration group "Device", functional block 30. Inquiry 7 is used for the factory setting of the input data block, and inquiry 8 for the factory setting of the output data block. It is possible to set the two data blocks independently of each other to a size between one and 16 words. -- The data blocks fixed with this are then transmitted cyclically between the DP master and the DP slave. --- Their size can be defined as described under "Configuration Instructions". -

Important
The new/modified setting of these values is only activated upon controller power on. - Therefore, switch the controller off and on again to activate a change. --- -

If this functionality is not needed since the configuration tool does not support the entry of slave-specific configuration data, answer both inquiries with 0 = unused.

Diagnostic Data

The diagnostic data of the controllers as DP slaves consist of 16 bytes. - These 16 bytes are composed of 6 bytes of standard diagnostic data, and 10 bytes of device-related diagnostic data. - - The length and the meaning of the standard diagnostic data are given by the PROFIBUS standard. - The first 3 bytes are called station status 1 to 3, bytes 4 to 6 contain additional information. - Every data package transmitted by the slave to the master informs the master about whether or not the slave has new diagnostic data. -If there is diagnostic data, the master requests this information from the slave with its next data telegram. The diagnostic data are then evaluated in the master, and the necessary actions can be taken.

Station status 1

	MSB						LSB
Bit number	7	6	5	4	3	2	1	0

Table 11

Description of the individual bits:

Bit number-	Description	Required actions
0	This bit is set by the DP master, if it cannot reach the DP slave via the bus. When this bit is set, the diagnostic bits assume the status of the last diagnostic message or the initial value. The DP slave sets this bit to 0. -----	Check the DP slave address setting in the device configuration. - Check the connectors for proper connection, and check repeaters or converters (if present) for proper FO cabling. ---
1	This bit is set by the DP slave, if the DP slave is not yet ready for data exchange. ---	The reason may be that the device is currently submitted to a configuration data check, or the supply voltage has been switched on recently and the device is still running up. Wait until the device works properly.---
2	This bit is set by the DP slave when the last configuration data received by the DP master are different from the last data transmitted by the DP slave. ----	Check parameters and configuration data to see whether or not the size of the storage areas specified by the modules is sufficient for transmitting the input and output data. -------
3	This bit is set by the DP slave - When this bit is set, this indicates that diagnostic data is available in the slave-specific diagnostic block. -	No actions required. The device-specific diagnostic data is detailed enough. --
4	This bit is set by the DP slave when it does not support the requested function. --	Check the parameter and configuration data given to the DP master for the DP slave. Compare with the device database file. - -----
5	This bit is set by the DP master when it receives an unplausible response from a polled slave. The DP slave sets this bit to 0. ----	Check the physical transmission path for faults like a missing shield connection or bus termination. -
6	This bit is set by the DP slave after reception of a faulty parameter telegram, e.g. with wrong length, wrong ID number, invalid parameters, etc. ---	Check the length of the "User_ Prm_Data". Make sure that the max. permissible number of bytes is not exceeded and the variable indices have valid values. -
7	The DP slave has been configured by another master. This bit is set by the DP master (Class 1 master) if the address in the 4th. byte of the standard diagnostic data is unequal to 255 and to the master's own address. The DP slave sets this bit to 0. -------	Use the master that has configured this DP slave for accessing the slave. ---

Station status 2

	MSB						LSB
Bit number	7	6	5	4	3	2	1	0

Table 12

This byte only contains status information data, which do not require any actions.

Description of the individual bits:

Bit numberDescription

Bit number	Description
0	This bit is set by the DP slave. -If the DP slave sets this bit, it must be reconfigured, and its parameters need to be redefined. -The bit remains set until the slave is reconfigured.
1	When the DP slave sets this bit, the DP master has to poll diagnostic data until the bit is unset again. -- For example, the DP slave sets this bit when it cannot provide valid usable data.
2	Always set to 1 by the DP slave.
3	This bit is set by the DP slave when its response monitoring function is activated. -
4	This bit is set by the DP slave upon reception of the Freeze control command. - -
5	This bit is set by the DP slave upon reception of the Sync. control command. - -
6	Reserved
7	This bit is set by the DP master as soon as the DP slave is marked as not active in the DP slave parameter set and is disabled for cyclic transmission. ----- The DP slave always sets this bit to 0.

Station status 3

Reserved. Is not set by the DP slave. -

Standard diagnostic data, 4th. byte

The address of the DP master that has configured this DP slave is written in this byte. -- If the DP slave has not been configured by a DP master, the DP master sets this byte to the address 255 (0xFF). ---

Standard diagnostic data, 5th. and 6th. byte

The ID number of the connected DP slave is written in these two bytes. --

Device-related diagnostic data, 7th. byte

	MSB							LSB
Bit number	7	6	5	4	3	2	1	0

Table 13

Description of the individual bits:

Bit	Description
0 to 5	Length of the device-related diagnostic data.- This value is 10 for controllers.
6 and 7	Fixed to 00. Describes the additional diagnostic data as device-specific diagnostic data. -- ID-related and channel-related diagnostic data are not available.

Device-related diagnostic data, 8th. byte

	MSB							LSB
Bit number	7	6	5	4	3	2	1	0

Table 14

Description of the individual bits (texts in quotation marks are diagnostic messages from the device database):-

Bit number -	Description	Actions to be taken
0	"I-block of slave too small" According to the configuration more bytes for input data are requested from this DP slave than specified in the device database. ----	Check the slave-specific configuration data handed over to the DP master and reduce the size, if required. Usually, this implies a change of the slave-specific parameter data, because they probably contain too many variable indices. ------- Bytes 12 to 16 of the device-specific diagnostic data contain additional information. ---

Bit number -	Description	Actions to be taken
1	"O-block of slave too small" In the configuration of this DP slave more bytes are requested for the output data than are specified in the device database. ----	Check the slave-specific configuration data handed over to the DP master and reduce their size, if required. Usually, this implies a change of the slave-specific parameter data, because they probably contain too many variable indices. ------- Bytes 12 to 16 of the device-related diagnostic data contain additional information. ---
2	"PRM conf greater than CFG data" Too many variable indices are written in the slave-specific parameter data. -----The required data block is greater than the block specified in the device-specific configuration. -	Reduce the number of variable indices in the slave-specific parameter data or increase the size specified in the slave-specific configuration data. --- - Bytes 12 to 16 of the device-specific diagnostic data contain additional information.
3	"PRM Data: Obj-Id faulty" - At least one variable byte index in the slave-specific parameter data is considered as faulty by the slave. --	Check the individual variable index bytes in the slave-specific parameter data. --- Bytes 12 to 16 of the device-specific diagnostic data contain more information.---

Bit number-	Description	Actions to be taken
4	"Unknown module in CFG" Probably, the slave-specific configuration data has been changed, and these changes are not accepted by the polled slave. ----	Check the slave-specific configuration data. Compare with the device database. -- Bytes 12 to 16 of the device-specific diagnostic data contain additional information. ---
5	"Acyclic: Data cannot be evaluated" An acyclic write or read service contains a variable index that is unknown to the contacted slave. -----	Check the contents of the acyclic telegram. Make sure that it contains correct and known variable indices. --- Bytes 12 to 16 of the device-specific diagnostic data contain additional information. ---
6	"Acycl: Unknown service" A service resides in a storage area for a request telegram which complies neither with the read job nor with the write job. ----	Check the contents of the acyclic telegrams for the proper service index. - Bytes 12 to 16 of the device-specific diagnostic data contain additional information. ---
7	"Acycl: Too many services"	Check the slave-specific configuration data and reduce the number of modules for acyclic read and write services to a maximum of four services. --- Refer to the device database for this. -

Device-related diagnostic data, 9th. byte

	MSB						LSB
Bit number -	7	6	5	4	3	2	1	0

Table 15

Description of the individual bits (texts in quotation marks are diagnostic messages from the device database):-

Bit number -	Description	Actions to be taken
0	"Controller power failure" (for later extensions) -	not yet implemented
1	"No communication with controller" The PROFIBUS-DP module cannot establish a communication with the basic device. --	A hardware defect of the device or module may be the reason. Check the basic device with another module and the module with another basic device. ----
2 to 7	for later extensions (not yet implemented)	

Device-related diagnostic data, 10th. and 11th. byte

for later extensions, (not yet implemented)

Device-related diagnostic data, 12th. to 16th. byte

This diagnostic data must be interpreted depending on the information from the 8th. and 9th. byte. Only if these bytes are unequal to 0x00, evaluable information is given here. -These bytes are not needed for all diagnostic bits

"I-block of slave too small"

Byte 12Always set to 0x00
Byte 13, 14 Necessary length of input data block in bytes, calculated from the configuration data. The maximum permissible length is specified in the device database (GSD file). -
Byte 15, 16 Necessary length of output data block in bytes, calculated from the configuration data. In this diagnostic data this value is smaller than the value specified in the device database (GSD file).

"O-data block of slave too small"

Byte 12Always set to 0x00
Byte 13, 14Necessary length of input data block in bytes, calculated from the configuration data. In this diagnostic data this value is smaller than the value specified in the device database (GSD file).
Byte 15, 16Necessary length of output data block in bytes, calculated from the configuration data. The maximum permissible length is specified in the device database (GSD file). -

"PRM conf greater than CFG data"

Byte 12always set to 0x00
Byte 13, 14Necessary length of input data block in bytes, calculated from the configuration data.
Byte 15, 16Necessary length of output data block in bytes, calculated from the configuration data.

"PRM data: Obj-Id faulty"

Byte 12Number of faulty bytes in the "User _Prm_Data". Counter starts with 1 and counts the bytes.
Byte 13, 14Faulty byte which is unknown to the connected slave.
Byte 15, 16Always set to 0x00.

"Unknown module in CFG"

Byte 12Position of faulty module in configuration data, counted from the start of the configuration data.-- Counter starts with 1 and counts the bytes.
Byte 13, 14The bytes specified in the configuration data for the first faulty module.
Byte 15, 16 Always set to 0x00.

"Acyclic: Data cannot be evaluated"

Byte 12Service index with a faulty variable index. -
Byte 13, 14Number of the acyclic service module in which the error was found. --Counted from 1 to 4.
Byte 15, 16Faulty variable index which is unknown to the connected slave. -

"Acyclic: Unknown service"

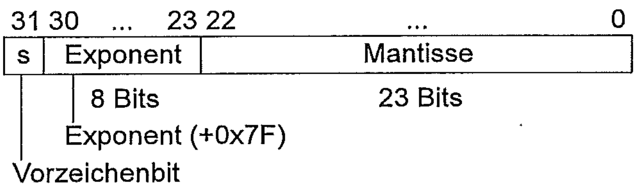
Byte 12Faulty service index for an acyclic service.
Byte 13, 14Number of the acyclic service module in which the error was found. - -Count from 1 to 4.
Byte 15, 16 Not used.

Numerical Formats and Displays

The controllers support REAL, INT, DINT (TIME) and BOOLean data.
The following tables give an overview of the support value ranges and the memory requirements for data transfer via PROFIBUS-DP:-

Data type	Value range	Required memory [bytes]
REAL	-1,175.494.35E-38	
	...	
	0.0	
	...	
	3,402.823.47E+39	4
INT	-32.768	
	...	
	0	
	...	
	32.767	2
DINT	-2.147.483.647	
	...	
	0	
	...	
	2.147.483.647	4
TIME	T#0s...T#99h59m59s	4
BOOL	FALSE (0 or 0x00) and TRUE (255 or 0xFF)	1

The format for REAL numbers used for the devices corresponds to the IEEE format. - -The diagram below shows this 32-bit format. ---



With data types occupying more than one byte the order in which these data bytes are to be transmitted on the bus can be defined. This is done by the fourth byte of the "User_Prm_Data". Which of the possible options is to be used depends on how the data is further processed by the Class 1 PROFIBUS DP master. Please refer to the respective master documentation for details. -----
The following illustrations give an overview of the order in which the data types are represented and transmitted in dependence of the fourth byte of "User_Prm_Data".-

Data type INT (Integer)

	MSB							LSB	
Bit number (High)	15	14	13	12	11	10	9	8	Byte 1
Significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	
Bit number	7	6	5	4	3	2	1	0	Byte 2 (Low)
Significance	27	26	25	24	23	22	21	20	

User_Prm_Data: 4th. byte = 0 or 0x00: Byte 2 sent before byte 1
4th byte = 255 or 0xFF: Byte 1 sent before Byte 2

Data type DINT (Double-Integer) and TIME

	MSB							LSB	
Bit number (High)	31	30	29	28	27	26	25	24	Byte 1
Significance	2^{31}	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}	
Bit number	23	22	21	20	19	18	17	16	Byte 2
Significance	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}	
Bit number	15	14	13	12	11	10	9	8	Byte 3
Significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	
Bit number	7	6	5	4	3	2	1	0	Byte 4 (Low)
Significance	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	

User_Prm_Data: 4th. byte = 0 or 0x00:
Byte 4 sent before Byte 3 before Byte 2 before Byte 1
4th. byte = 255 or 0xFF:
Byte 1 sent before Byte 2 before Byte 3 before Byte 4

Data type REAL (Float)

	MSB							LSB	
Bit number (High)	31	30	29	28	27	26	25	24	Byte 1
Significance	VZ	E8	E7	E6	E5	E4	E3	E2	
Bit number	23	22	21	20	19	18	17	16	Byte 2
Significance	E1	M22	M21	M20	M19	M18	M17	M16	
Bit number	15	14	13	12	11	10	9	8	Byte 3
Significance	M15	M14	M13	M12	M11	M10	M9	M8	
Bit number	7	6	5	4	3	2	1	0	Byte 4 (Low)
Significance	M7	M6	M5	M4	M3	M2	M1	M0	

VZ = Sign bit
E.. = Exponent bit
M.. = Mantissa bit

User_Prm_Data: 4th. byte = 0 or 0x00:
Byte 4 sent before Byte 3 before Byte 2 before Byte 1
4th. byte = 255 or 0xFF:
Byte 1 sent before Byte 2 before Byte 3 before Byte 4

Addressing the Data

The addressing of the individual system variables is based on the method used for MODBUS communication. --However, no distinction is made between individual data types. A unique variable index is assigned to every system and online variable to distinguish the individual data from each other. The variable index must be specified as a 16-bit integer for the controllers. --
When writing slave-specific parameter definitions, it is often necessary to enter the data in hexadecimal format. Therefore, all variable indices are listed in the "Tables" section in both decimal and hexadecimal format. --

Often, hexadecimal data must be entered byte by byte. Since, usually, the lower part must be entered to the left of the higher part, first the two right digits of a 4-digit hexadecimal number are entered, and then the two digits following 0x..... ---- For example, variable index 0x0367 written in byte-by-byte format gives the sequence 0x67, 0x03.

REAL, DINT, TIME and INT Variables

For system variables that have been read and written using recording services (REAL, DINT, TIME and INT data), the record number for MODBUS has to be increased by 1 to yield the PROFIBUS DP variable index. ---

Example

System variable .L1_WAKT (REAL)
MODBUS register 822 and 823
Variable index 823 (0x0337) for PROFIBUS-DP

BOOLean Variables

For system variables that have been read and written using coil services (BOOLean data), the coil number increased by 1501 is the variable index for PROFIBUS DP. --

Example

System variable .AA01BUE
MODBUS coil 99
Variable index 1600 (0x0640) for PROFIBUS-DP

Online Parameters

CAUTION
Do not write cyclically on online parameters!

The following mapping regulations apply to the calculation of the variable index for accessing online parameters. -- Refer to the commissioning instructions for the respective device for the parameter number. --

Device

Variable index (decimal) =
10001 + 2 × parameter number

Control loops

Variable index (decimal) =
10001 + 1000 × loop number + 2 × parameter number

Loop 1 11003 - 12000
Loop 2 12003 - 13000
Loop 3 13003 - 14000
Loop 4 14003 - 15000

Program 1...10

Variable index (decimal) =
14801 + 200 × program number + 2 × parameter number

Program 1 15003 - 15200
Program 2 15203 - 15400
...
Program 10 16803 - 17000

Notes on the variable index tables for system variables seen on the following pages:-

Since the configuration tools for PROFIBUS DP systems often provide different entry options for user-defined parameter data, the system variables are listed in both decimal and hexadecimal format. ---

The tables are in alphabetic order to enable easy finding of the respective variable.

Tables

Analog inputs

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1	0x0001	0xFFFF	.AE01	REAL	Analog input 01
1502	0x05DE	0xFA22	.AE01ERR	BOOL	Error of AI01
3	0x0003	0xFFFD	.AE02	REAL	Analog input 02
1503	0x05DF	0xFA21	.AE02ERR	BOOL	Error of AI02
5	0x0005	0xFFFB	.AE11	REAL	Analog input 11
1512	0x05E8	0xFA18	.AE11ERR	BOOL	Error of AI11
7	0x0007	0xFFF9	.AE12	REAL	Analog input 12
1513	0x05E9	0xFA17	.AE12ERR	BOOL	Error of AI12
9	0x0009	0xFFF7	.AE13	REAL	Analog input 13
1514	0x05EA	0xFA16	.AE13ERR	BOOL	Error of AI13
11	0x000B	0xFFF5	.AE14	REAL	Analog input 14
1515	0x05EB	0xFA15	.AE14ERR	BOOL	Error of AI14
13	0x000D	0xFFF3	.AE21	REAL	Analog input 21
1522	0x05F2	0xFA0E	.AE21ERR	BOOL	Error of AI21
15	0x000F	0xFFF1	.AE22	REAL	Analog input 22
1523	0x05F3	0xFA0D	.AE22ERR	BOOL	Error of AI22
17	0x0011	0xFFEF	.AE23	REAL	Analog input 23
1524	0x05F4	0xFA0C	.AE23ERR	BOOL	Error of AI23
19	0x0013	0xFFED	.AE24	REAL	Analog input 24
1525	0x05F5	0xFA0B	.AE24ERR	BOOL	Error of AI24
21	0x0015	0xFFEB	.AE31	REAL	Analog input 31
1532	0x05FC	0xFA04	.AE31ERR	BOOL	Error of AI31
23	0x0017	0xFFE9	.AE32	REAL	Analog input 32
1533	0x05FD	0xFA03	.AE32ERR	BOOL	Error of AI32
25	0x0019	0xFFE7	.AE33	REAL	Analog input 33
1534	0x05FE	0xFA02	.AE33ERR	BOOL	Error of AI33
27	0x001B	0xFFE5	.AE34	REAL	Analog input 34
1535	0x05FF	0xFA01	.AE34ERR	BOOL	Error of AI34
29	0x001D	0xFFE3	.AE41	REAL	Analog input 41
1542	0x0606	0xF9FA	.AE41ERR	BOOL	Error of AI41
31	0x001F	0xFFE1	.AE42	REAL	Analog input 42
1543	0x0607	0xF9F9	.AE42ERR	BOOL	Error of AI42
33	0x0021	0xFFDF	.AE43	REAL	Analog input 43
1544	0x0608	0xF9F8	.AE43ERR	BOOL	Error of AI43
35	0x0023	0xFFDD	.AE44	REAL	Analog input 44
1545	0x0609	0xF9F7	.AE44ERR	BOOL	Error of AI44
37	0x0025	0xFFDB	.AE51	REAL	Analog input 51
1552	0x0610	0xF9F0	.AE51ERR	BOOL	Error of AI51
39	0x0027	0xFFD9	.AE52	REAL	Analog input 52
1553	0x0611	0xF9EF	.AE52ERR	BOOL	Error of AI52
41	0x0029	0xFFD7	.AE53	REAL	Analog input 53
1554	0x0612	0xF9EE	.AE53ERR	BOOL	Error of AI53
43	0x002B	0xFFD5	.AE54	REAL	Analog input 54
1555	0x0613	0xF9ED	.AE54ERR	BOOL	Error of AI54
45	0x002D	0xFFD3	.AE61	REAL	Analog input 61
1562	0x061A	0xF9E6	.AE61ERR	BOOL	Error of AI61
47	0x002F	0xFFD1	.AE62	REAL	Analog input 62
1563	0x061B	0xF9E5	.AE62ERR	BOOL	Error of AI62
49	0x0031	0xFFCF	.AE63	REAL	Analog input 63
1564	0x061C	0xF9E4	.AE63ERR	BOOL	Error of AI63
51	0x0033	0xFFCD	.AE64	REAL	Analog input 64
1565	0x061D	0xF9E3	.AE64ERR	BOOL	Error of AI64
53	0x0035	0xFFCB	.AE71	REAL	Analog input 71
1572	0x0624	0xF9DC	.AE71ERR	BOOL	Error of AI71
55	0x0037	0xFFC9	.AE72	REAL	Analog input 72
1573	0x0625	0xF9DB	.AE72ERR	BOOL	Error of AI72
57	0x0039	0xFFC7	.AE73	REAL	Analog input 73
1574	0x0626	0xF9DA	.AE73ERR	BOOL	Error of AI73
59	0x003B	0xFFC5	.AE74	REAL	Analog input 74
1575	0x0627	0xF9D9	.AE74ERR	BOOL	Error of AI74

Analog outputs

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
71	0x0047	0xFFB9	.AA01	REAL	Analog output 01
1600	0x0640	0xF9C0	.AA01BUE	BOOL	Error of AO01
73	0x0049	0xFFB7	.AA11	REAL	Analog output 02
1601	0x0641	0xF9BF	.AA11BUE	BOOL	Error of AO11
75	0x004B	0xFFB5	.AA12	REAL	Analog output 11
1602	0x0642	0xF9BE	.AA12BUE	BOOL	Error of AO12
77	0x004D	0xFFB3	.AA13	REAL	Analog output 12
1603	0x0643	0xF9BD	.AA13BUE	BOOL	Error of AO13
81	0x0051	0xFFAF	.AA21	REAL	Analog output 21
1606	0x0646	0xF9BA	.AA21BUE	BOOL	Error of AO21
83	0x0053	0xFFAD	.AA22	REAL	Analog output 22
1607	0x0647	0xF9B9	.AA22BUE	BOOL	Error of AO22
85	0x0055	0xFFAB	.AA23	REAL	Analog output 23
1608	0x0648	0xF9B8	.AA23BUE	BOOL	Error of AO23
89	0x0059	0xFFA7	.AA31	REAL	Analog output 31
1610	0x064A	0xF9B6	.AA31BUE	BOOL	Error of AO31
91	0x005B	0xFFA5	.AA32	REAL	Analog output 32
1611	0x064B	0xF9B5	.AA32BUE	BOOL	Error of AO32
93	0x005D	0xFFA3	.AA33	REAL	Analog output 33
1612	0x064C	0xF9B4	.AA33BUE	BOOL	Error of AO33
97	0x0061	0xFF9F	.AA41	REAL	Analog output 41
1614	0x064E	0xF9B2	.AA41BUE	BOOL	Error of AO41
99	0x0063	0xFF9D	.AA42	REAL	Analog output 42
1615	0x064F	0xF9B1	.AA42BUE	BOOL	Error of AO42
101	0x0065	0xFF9B	.AA43	REAL	Analog output 43
1616	0x0650	0xF9B0	.AA43BUE	BOOL	Error of AO43
105	0x0069	0xFF97	.AA51	REAL	Analog output 51
1618	0x0652	0xF9AE	.AA51BUE	BOOL	Error of AO51
107	0x006B	0xFF95	.AA52	REAL	Analog output 52
1619	0x0653	0xF9AD	.AA52BUE	BOOL	Error of AO52
109	0x006D	0xFF93	.AA53	REAL	Analog output 53
1620	0x0654	0xF9AC	.AA53BUE	BOOL	Error of AO53
113	0x0071	0xFF8F	.AA61	REAL	Analog output 61
1622	0x0656	0xF9AA	.AA61BUE	BOOL	Error of AO61
115	0x0073	0xFF8D	.AA62	REAL	Analog output 62
1623	0x0657	0xF9A9	.AA62BUE	BOOL	Error of AO62
117	0x0075	0xFF8B	.AA63	REAL	Analog output 63
1624	0x0658	0xF9A8	.AA63BUE	BOOL	Error of AO63
121	0x0079	0xFF87	.AA71	REAL	Analog output 71
1626	0x065A	0xF9A6	.AA71BUE	BOOL	Error of AO71
123	0x007B	0xFF85	.AA72	REAL	Analog output 72
1627	0x065B	0xF9A5	.AA72BUE	BOOL	Error of AO72
125	0x007D	0xFF83	.AA73	REAL	Analog output 73
1628	0x065C	0xF9A4	.AA73BUE	BOOL	Error of AO73

Digital inputs

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1652	0x0674	0xF98C	.BE01	BOOL	Digital input 01
1653	0x0675	0xF98B	.BE02	BOOL	Digital input 02
1654	0x0676	0xF98A	.BE03	BOOL	Digital input 03
1655	0x0677	0xF989	.BE04	BOOL	Digital input 04
1656	0x0678	0xF988	.BE11	BOOL	Digital input 11
1657	0x0679	0xF987	.BE12	BOOL	Digital input 12
1658	0x067A	0xF986	.BE13	BOOL	Digital input 13
1659	0x067B	0xF985	.BE14	BOOL	Digital input 14
1660	0x067C	0xF984	.BE15	BOOL	Digital input 15
1661	0x067D	0xF983	.BE16	BOOL	Digital input 16
1662	0x067E	0xF982	.BE21	BOOL	Digital input 21
1663	0x067F	0xF981	.BE22	BOOL	Digital input 22
1664	0x0680	0xF980	.BE23	BOOL	Digital input 23
1665	0x0681	0xF97F	.BE24	BOOL	Digital input 24
1666	0x0682	0xF97E	.BE25	BOOL	Digital input 25
1667	0x0683	0xF97D	.BE26	BOOL	Digital input 26
1668	0x0684	0xF97C	.BE31	BOOL	Digital input 31
1669	0x0685	0xF97B	.BE32	BOOL	Digital input 32
1670	0x0686	0xF97A	.BE33	BOOL	Digital input 33
1671	0x0687	0xF979	.BE34	BOOL	Digital input 34
1672	0x0688	0xF978	.BE35	BOOL	Digital input 35
1673	0x0689	0xF977	.BE36	BOOL	Digital input 36
1674	0x068A	0xF976	.BE41	BOOL	Digital input 41
1675	0x068B	0xF975	.BE42	BOOL	Digital input 42
1676	0x068C	0xF974	.BE43	BOOL	Digital input 43
1677	0x068D	0xF973	.BE44	BOOL	Digital input 44
1678	0x068E	0xF972	.BE45	BOOL	Digital input 45
1679	0x068F	0xF971	.BE46	BOOL	Digital input 46
1680	0x0690	0xF970	.BE51	BOOL	Digital input 51
1681	0x0691	0xF96F	.BE52	BOOL	Digital input 52
1682	0x0692	0xF96E	.BE53	BOOL	Digital input 53
1683	0x0693	0xF96D	.BE54	BOOL	Digital input 54
1684	0x0694	0xF96C	.BE55	BOOL	Digital input 55
1685	0x0695	0xF96B	.BE56	BOOL	Digital input 56
1686	0x0696	0xF96A	.BE61	BOOL	Digital input 61
1687	0x0697	0xF969	.BE62	BOOL	Digital input 62
1688	0x0698	0xF968	.BE63	BOOL	Digital input 63
1689	0x0699	0xF967	.BE64	BOOL	Digital input 64
1690	0x069A	0xF966	.BE65	BOOL	Digital input 65
1691	0x069B	0xF965	.BE66	BOOL	Digital input 66
1692	0x069C	0xF964	.BE71	BOOL	Digital input 71
1693	0x069D	0xF963	.BE72	BOOL	Digital input 72
1694	0x069E	0xF962	.BE73	BOOL	Digital input 73
1695	0x069F	0xF961	.BE74	BOOL	Digital input 74
1696	0x06A0	0xF960	.BE75	BOOL	Digital input 75
1697	0x06A1	0xF95F	.BE76	BOOL	Digital input 76

Digital outputs

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1722	0x06BA	0xF946	.BA01	BOOL	Digital output 01
1723	0x06BB	0xF945	.BA02	BOOL	Digital output 02
1724	0x06BC	0xF944	.BA03	BOOL	Digital output 03
1725	0x06BD	0xF943	.BA04	BOOL	Digital output 04
1726	0x06BE	0xF942	.BA11	BOOL	Digital output 11
1727	0x06BF	0xF941	.BA12	BOOL	Digital output 12
1728	0x06C0	0xF940	.BA13	BOOL	Digital output 13
1729	0x06C1	0xF93F	.BA14	BOOL	Digital output 14
1730	0x06C2	0xF93E	.BA15	BOOL	Digital output 15
1731	0x06C3	0xF93D	.BA16	BOOL	Digital output 16
1732	0x06C4	0xF93C	.BA21	BOOL	Digital output 21
1733	0x06C5	0xF93B	.BA22	BOOL	Digital output 22
1734	0x06C6	0xF93A	.BA23	BOOL	Digital output 23
1735	0x06C7	0xF939	.BA24	BOOL	Digital output 24
1736	0x06C8	0xF938	.BA25	BOOL	Digital output 25
1737	0x06C9	0xF937	.BA26	BOOL	Digital output 26
1738	0x06CA	0xF936	.BA31	BOOL	Digital output 31
1739	0x06CB	0xF935	.BA32	BOOL	Digital output 32
1740	0x06CC	0xF934	.BA33	BOOL	Digital output 33
1741	0x06CD	0xF933	.BA34	BOOL	Digital output 34
1742	0x06CE	0xF932	.BA35	BOOL	Digital output 35
1743	0x06CF	0xF931	.BA36	BOOL	Digital output 36
1744	0x06D0	0xF930	.BA41	BOOL	Digital output 41
1745	0x06D1	0xF92F	.BA42	BOOL	Digital output 42
1746	0x06D2	0xF92E	.BA43	BOOL	Digital output 43
1747	0x06D3	0xF92D	.BA44	BOOL	Digital output 44
1748	0x06D4	0xF92C	.BA45	BOOL	Digital output 45
1749	0x06D5	0xF92B	.BA46	BOOL	Digital output 46
1750	0x06D6	0xF92A	.BA51	BOOL	Digital output 51
1751	0x06D7	0xF929	.BA52	BOOL	Digital output 52
1752	0x06D8	0xF928	.BA53	BOOL	Digital output 53
1753	0x06D9	0xF927	.BA54	BOOL	Digital output 54
1754	0x06DA	0xF926	.BA55	BOOL	Digital output 55
1755	0x06DB	0xF925	.BA56	BOOL	Digital output 56
1756	0x06DC	0xF924	.BA61	BOOL	Digital output 61
1757	0x06DD	0xF923	.BA62	BOOL	Digital output 62
1758	0x06DE	0xF922	.BA63	BOOL	Digital output 63
1759	0x06DF	0xF921	.BA64	BOOL	Digital output 64
1760	0x06E0	0xF920	.BA65	BOOL	Digital output 65
1761	0x06E1	0xF91F	.BA66	BOOL	Digital output 66
1762	0x06E2	0xF91E	.BA71	BOOL	Digital output 71
1763	0x06E3	0xF91D	.BA72	BOOL	Digital output 72
1764	0x06E4	0xF91C	.BA73	BOOL	Digital output 73
1765	0x06E5	0xF91B	.BA74	BOOL	Digital output 74
1766	0x06E6	0xF91A	.BA75	BOOL	Digital output 75
1767	0x06E7	0xF919	.BA76	BOOL	Digital output 76

Loop 1

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
227	0x00E3	0xFF1D	.INDS_LOOP1	INT	Display loop position
1822	0x071E	0xF8E2	.L1_A_VORB	BOOL	AUTOMATIC mode ready
245	0x00F5	0xFF0B	.L1_ANA_LO	REAL	Lower bargraph scaling
247	0x00F7	0xFF09	.L1_ANA_HI	REAL	Upper bargraph scaling
1821	0x071D	0xF8E3	.L1_B1	BOOL	Change-over ES1/ES2
225	0x00E1	0xFF1F	.L1_BA_YOUT	REAL	Output variable feedback signal
1825	0x0721	0xF8DF	.L1_BETART_UM	BOOL	Request mode change-over
1824	0x0720	0xF8E0	.L1_C_VORB	BOOL	CASCADE mode ready
827	0x033B	0xFCC5	.L1_D	REAL	Signal for D of PID
291	0x0123	0xFEDD	.L1_D1	DINT	Free DINT variable
293	0x0125	0xFEDB	.L1_D2	DINT	Free DINT variable
295	0x0127	0xFED9	.L1_D3	DINT	Free DINT variable
297	0x0129	0xFED7	.L1_D4	DINT	Free DINT variable
151	0x0097	0xFF69	.L1_ES1	REAL	1st. input of input circuit
153	0x0099	0xFF67	.L1_ES2	REAL	2nd. input of input circuit
155	0x009B	0xFF65	.L1_ES3	REAL	3rd. input of input circuit
157	0x009D	0xFF63	.L1_ES4	REAL	4th. input of input circuit
159	0x009F	0xFF61	.L1_ES5	REAL	5th. input of input circuit
1834	0x072A	0xF8D6	.L1_GW1_OUT	BOOL	Violation of limit value L1-LV1
1835	0x072B	0xF8D5	.L1_GW2_OUT	BOOL	Violation of limit value L1-LV2
1836	0x072C	0xF8D4	.L1_GW3_OUT	BOOL	Violation of limit value L1-LV3
1837	0x072D	0xF8D3	.L1_GW4_OUT	BOOL	Violation of limit value L1-LV4
1829	0x0725	0xF8DB	.L1_HAND_M	BOOL	Step output MORE
1830	0x0726	0xF8DA	.L1_HAND_W	BOOL	Step output LESS
177	0x00B1	0xFF4F	.L1_K1	REAL	Evaluation factor K1
179	0x00B3	0xFF4D	.L1_K2	REAL	Evaluation factor K2
181	0x00B5	0xFF4B	.L1_K3	REAL	Evaluation factor K3
183	0x00B7	0xFF49	.L1_K4	REAL	Evaluation factor K4
943	0x03AF	0xFC51	.L1_K5	REAL	Evaluation factor K5
945	0x03B1	0xFC4F	.L1_K6	REAL	Evaluation factor K6
947	0x03B3	0xFC4D	.L1_K7	REAL	Evaluation factor K7
949	0x03B5	0xFC4B	.L1_K8	REAL	Evaluation factor K8
951	0x03B7	0xFC49	.L1_K9	REAL	Evaluation factor K9
953	0x03B9	0xFC47	.L1_K10	REAL	Evaluation factor K10
955	0x03BB	0xFC45	.L1_K11	REAL	Evaluation factor K11
957	0x03BD	0xFC43	.L1_K12	REAL	Evaluation factor K12
959	0x03BF	0xFC41	.L1_K13	REAL	Evaluation factor K13
961	0x03C1	0xFC3F	.L1_K14	REAL	Evaluation factor K14
963	0x03C3	0xFC3D	.L1_K15	REAL	Evaluation factor K15
965	0x03C5	0xFC3B	.L1_K16	REAL	Evaluation factor K16
199	0x00C7	0xFF39	.L1_KP_STEUER	REAL	Effective P-gain
201	0x00C9	0xFF37	.L1_KS_STEUER	REAL	Effective amplification constant Ks
249	0x00F9	0xFF07	.L1_LAMBDA	REAL	
1823	0x071F	0xF8E1	.L1_M_VORB	BOOL	MAN mode ready
1840	0x0730	0xF8D0	.L1_MAN_AUTO	BOOL	Controller in AUTO or MAN mode
1841	0x0731	0xF8CF	.L1_MAN_CAS	BOOL	Controller in CASCADE or MAN mode
215	0x00D7	0xFF29	.L1_PID_D_OUT	REAL	D-Portion of output signal
213	0x00D5	0xFF2B	.L1_PID_I_OUT	REAL	I-Portion of output signal
1838	0x072E	0xF8D2	.L1_PID_PS	BOOL	Change-over parameter set 1<->2
831	0x033F	0xFCC1	.L1_PID_Y_OUT	REAL	Cont. output signal
271	0x010F	0xFEF1	.L1_R1	REAL	Free REAL variable
273	0x0111	0xFEEF	.L1_R2	REAL	Free REAL variable
275	0x0113	0xFEED	.L1_R3	REAL	Free REAL variable
277	0x0115	0xFEEB	.L1_R4	REAL	Free REAL variable
279	0x0117	0xFEE9	.L1_R5	REAL	Free REAL variable
281	0x0119	0xFEE7	.L1_R6	REAL	Free REAL variable
283	0x011B	0xFEE5	.L1_R7	REAL	Free REAL variable
285	0x011D	0xFEE3	.L1_R8	REAL	Free REAL variable
1826	0x0722	0xF8DE	.L1_REGLER_AUTO	BOOL	Controller AUTO
1828	0x0724	0xF8DC	.L1_REGLER_C	BOOL	Controller CASCADE
1827	0x0723	0xF8DD	.L1_REGLER_MAN	BOOL	Controller MAN
221	0x00DD	0xFF23	.L1_SCAL_LO	REAL	Lower control loop scaling
223	0x00DF	0xFF21	.L1_SCAL_HI	REAL	Upper control loop scaling
1844	0x0734	0xF8CC	.L1_SETZ_AUTO	BOOL	Change-over to automatic mode
1845	0x0735	0xF8CB	.L1_SETZ_CASC	BOOL	Change-over to cascade mode

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1843	0x0733	0xF8CD	.L1_SETZ_MAN	BOOL	Change-over to man. mode
1049	0x0419	0xFBE7	.L1_SETZ_W	INT	Change-over to setpoint source
269	0x010D	0xFEF3	.L1_SKALV	REAL	Scaling factor ratio with LOAD AIR
1839	0x072F	0xF8D1	.L1_SPAKTIV	BOOL	Auto-configuration active
287	0x011F	0xFEE1	.L1_T1	DINT	Free time variable
211	0x00D3	0xFF2D	.L1_T1_STEUER	REAL	Effective delay time T1
289	0x0121	0xFEDF	.L1_T2	DINT	Free time variable
195	0x00C3	0xFF3D	.L1_TIME_DPS_MAN	DINT	Step output increment [ms]
203	0x00CB	0xFF35	.L1_TN_STEUER	REAL	Effective integral action time [min]
209	0x00D1	0xFF2F	.L1_TT_STEUER	REAL	Effective dead time Tt [min]
205	0x00CD	0xFF33	.L1_TV_STEUER	REAL	Effective derivative action time [min]
241	0x00F1	0xFF0F	.L1_V	REAL	Setpoint ratio
1833	0x0729	0xF8D7	.L1_V_F	BOOL	Fixed value/ratio status
243	0x00F3	0xFF0D	.L1_VISTDIGI	REAL	Actual ratio
257	0x0101	0xFEFF	.L1_W_FOLGE	REAL	Setpoint for slave control in cascade
1832	0x0728	0xF8D8	.L1_W_STATUS	BOOL	
823	0x0337	0xFCC9	.L1_WAKT	REAL	Current setpoint
173	0x00AD	0xFF53	.L1_WANA	REAL	
253	0x00FD	0xFF03	.L1_WANA_SKAL	REAL	SP bargraph
229	0x00E5	0xFF1B	.L1_WCOMPUTER	REAL	Computer target setpoint
175	0x00AF	0xFF51	.L1_WDIGI	REAL	Current setpoint
267	0x010B	0xFEF5	.L1_WEXT	REAL	External setpoint
1842	0x0732	0xF8CE	.L1_WEXT_AKTIV	BOOL	External SP active
231	0x00E7	0xFF19	.L1_WSOLL0	REAL	Target setpoint 1
233	0x00E9	0xFF17	.L1_WSOLL1	REAL	Target setpoint 2
235	0x00EB	0xFF15	.L1_WSOLL2	REAL	Target setpoint 3
237	0x00ED	0xFF13	.L1_WSOLL3	REAL	Target setpoint 4
821	0x0335	0xFCCB	.L1_WW	REAL	Effective setpoint
167	0x00A7	0xFF59	.L1_XANA	REAL	
251	0x00FB	0xFF05	.L1_XANA_SKAL	REAL	PV bargraph
825	0x0339	0xFCC7	.L1_XDIGI	REAL	Digital display
829	0x033D	0xFCC3	.L1_XW	REAL	Control deviation in engineering units
187	0x00BB	0xFF45	.L1_XW_EU	REAL	Control deviation in engineering units
189	0x00BD	0xFF43	.L1_XW_PRZ	REAL	Control deviation in %
207	0x00CF	0xFF31	.L1_Y0_STEUER	REAL	Effective operating point [%]
255	0x00FF	0xFF01	.L1_YCOMPUTER	REAL	OUT COMPUTER with DDC
197	0x00C5	0xFF3B	.L1_YHAND	REAL	Man. value of output variable
191	0x00BF	0xFF41	.L1_YMAX	REAL	Max. output value
261	0x0105	0xFEFB	.L1_YMAX_BR	REAL	Override selection for override controller
265	0x0109	0xFEF7	.L1_YMAX_HR	REAL	Override selection for master controller, MIN. selection
193	0x00C1	0xFF3F	.L1_YMIN	REAL	Min. output value
259	0x0103	0xFEFD	.L1_YMIN_BR	REAL	OUT-Min override selection for override controller
263	0x0107	0xFEF9	.L1_YMIN_HR	REAL	Override selection for master controller, MAX. selection
219	0x00DB	0xFF25	.L1_YSRUECK	REAL	Position feedback
163	0x00A3	0xFF5D	.L1_YTRACK	REAL	OUT tracking signal in AUTO mode
1795	0x0703	0xF8FD	.SLH_LOOP1	BOOL	Loop 1 in display
796	0x031C	0xFCE4	.WW_LOOP1	INT	Index of selected setpoint loop 1

Loop 2

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
377	0x0179	0xFE87	.INDS_LOOP2	INT	Display loop position
1862	0x0746	0xF8BA	.L2_A_VORB	BOOL	AUTOMATIC mode ready
395	0x018B	0xFE75	.L2_ANA_LO	REAL	Lower bargraph scaling
397	0x018D	0xFE73	.L2_ANA_HI	REAL	Upper bargraph scaling
1861	0x0745	0xF8BB	.L2_B1	BOOL	Change-over ES1/ES2
375	0x0177	0xFE89	.L2_BA_YOUT	REAL	Output variable feedback signal
1865	0x0749	0xF8B7	.L2_BETART_UM	BOOL	Request mode change-over
1864	0x0748	0xF8B8	.L2_C_VORB	BOOL	CASCADE mode ready
847	0x034F	0xFCB1	.L2_D	REAL	Signal for D of PID
441	0x01B9	0xFE47	.L2_D1	DINT	Free DINT variable
443	0x01BB	0xFE45	.L2_D2	DINT	Free DINT variable
445	0x01BD	0xFE43	.L2_D3	DINT	Free DINT variable
447	0x01BF	0xFE41	.L2_D4	DINT	Free DINT variable
301	0x012D	0xFED3	.L2_ES1	REAL	1st. input of input circuit
303	0x012F	0xFED1	.L2_ES2	REAL	2nd. input of input circuit
305	0x0131	0xFECF	.L2_ES3	REAL	3rd. input of input circuit
307	0x0133	0xFECD	.L2_ES4	REAL	4th. input of input circuit
309	0x0135	0xFECB	.L2_ES5	REAL	5th. input of input circuit
1874	0x0752	0xF8AE	.L2_GW1_OUT	BOOL	Violation of limit value L2-LV1
1875	0x0753	0xF8AD	.L2_GW2_OUT	BOOL	Violation of limit value L2-LV2
1876	0x0754	0xF8AC	.L2_GW3_OUT	BOOL	Violation of limit value L2-LV3
1877	0x0755	0xF8AB	.L2_GW4_OUT	BOOL	Violation of limit value L2-LV4
1869	0x074D	0xF8B3	.L2_HAND_M	BOOL	Step output MORE
1870	0x074E	0xF8B2	.L2_HAND_W	BOOL	Step output LESS
327	0x0147	0xFEB9	.L2_K1	REAL	Evaluation factor K1
329	0x0149	0xFEB7	.L2_K2	REAL	Evaluation factor K2
331	0x014B	0xFEB5	.L2_K3	REAL	Evaluation factor K3
333	0x014D	0xFEB3	.L2_K4	REAL	Evaluation factor K4
967	0x03C7	0xFC39	.L2_K5	REAL	Evaluation factor K5
969	0x03C9	0xFC37	.L2_K6	REAL	Evaluation factor K6
971	0x03CB	0xFC35	.L2_K7	REAL	Evaluation factor K7
973	0x03CD	0xFC33	.L2_K8	REAL	Evaluation factor K8
975	0x03CF	0xFC31	.L2_K9	REAL	Evaluation factor K9
977	0x03D1	0xFC2F	.L2_K10	REAL	Evaluation factor K10
979	0x03D3	0xFC2D	.L2_K11	REAL	Evaluation factor K11
981	0x03D5	0xFC2B	.L2_K12	REAL	Evaluation factor K12
983	0x03D7	0xFC29	.L2_K13	REAL	Evaluation factor K13
985	0x03D9	0xFC27	.L2_K14	REAL	Evaluation factor K14
987	0x03DB	0xFC25	.L2_K15	REAL	Evaluation factor K15
989	0x03DD	0xFC23	.L2_K16	REAL	Evaluation factor K16
349	0x015D	0xFEA3	.L2_KP_STEUER	REAL	Effective P-gain
351	0x015F	0xFEA1	.L2_KS_STEUER	REAL	Effective amplification constant Ks
399	0x018F	0xFE71	.L2_LAMBDA	REAL	
1863	0x0747	0xF8B9	.L2_M_VORB	BOOL	MAN mode ready
1880	0x0758	0xF8A8	.L2_MAN_AUTO	BOOL	Controller in AUTO or MAN mode
1881	0x0759	0xF8A7	.L2_MAN_CAS	BOOL	Controller in CASCADE or MAN mode
365	0x016D	0xFE93	.L2_PID_D_OUT	REAL	D-portion of output signal
363	0x016B	0xFE95	.L2_PID_I_OUT	REAL	I-portion of output signal
1878	0x0756	0xF8AA	.L2_PID_PS	BOOL	Change-over parameter set 1<->2
851	0x0353	0xFCAD	.L2_PID_Y_OUT	REAL	Cont. output signal
421	0x01A5	0xFE5B	.L2_R1	REAL	Free REAL variable
423	0x01A7	0xFE59	.L2_R2	REAL	Free REAL variable
425	0x01A9	0xFE57	.L2_R3	REAL	Free REAL variable
427	0x01AB	0xFE55	.L2_R4	REAL	Free REAL variable
429	0x01AD	0xFE53	.L2_R5	REAL	Free REAL variable
431	0x01AF	0xFE51	.L2_R6	REAL	Free REAL variable
433	0x01B1	0xFE4F	.L2_R7	REAL	Free REAL variable
435	0x01B3	0xFE4D	.L2_R8	REAL	Free REAL variable
1866	0x074A	0xF8B6	.L2_REGLER_AUTO	BOOL	Controller AUTO
1868	0x074C	0xF8B4	.L2_REGLER_C	BOOL	Controller CASCADE
1867	0x074B	0xF8B5	.L2_REGLER_MAN	BOOL	Controller MAN
371	0x0173	0xFE8D	.L2_SCAL_LO	REAL	Lower control loop scaling
373	0x0175	0xFE8B	.L2_SCAL_HI	REAL	Upper control loop scaling
1884	0x075C	0xF8A4	.L2_SETZ_AUTO	BOOL	Change-over to automatic mode
1885	0x075D	0xF8A3	.L2_SETZ_CASC	BOOL	Change-over to cascade mode

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1883	0x075B	0xF8A5	.L2_SETZ_MAN	BOOL	Change-over to man. mode
1050	0x041A	0xFBE6	.L2_SETZ_W	INT	Change-over to setpoint source
419	0x01A3	0xFE5D	.L2_SKALV	REAL	Scaling factor ratio with LOAD AIR
1879	0x0757	0xF8A9	.L2_SPAKTIV	BOOL	Auto-configuration active
437	0x01B5	0xFE4B	.L2_T1	DINT	Free time variable
361	0x0169	0xFE97	.L2_T1_STEUER	REAL	Effective delay time T1
439	0x01B7	0xFE49	.L2_T2	DINT	Free time variable
345	0x0159	0xFEA7	.L2_TIME_DPS_MAN	DINT	Step output increment [ms]
353	0x0161	0xFE9F	.L2_TN_STEUER	REAL	Effective integral action time [min]
359	0x0167	0xFE99	.L2_TT_STEUER	REAL	Effective dead time Tt [min]
355	0x0163	0xFE9D	.L2_TV_STEUER	REAL	Effective derivative action time [min]
391	0x0187	0xFE79	.L2_V	REAL	Setpoint ratio
1873	0x0751	0xF8AF	.L2_V_F	BOOL	Fixed value/ratio status
393	0x0189	0xFE77	.L2_VISTDIGI	REAL	Actual ratio
407	0x0197	0xFE69	.L2_W_FOLGE	REAL	Setpoint for slave control in cascade
1872	0x0750	0xF8B0	.L2_W_STATUS	BOOL	
843	0x034B	0xFCB5	.L2_WAKT	REAL	Current setpoint
323	0x0143	0xFEBD	.L2_WANA	REAL	
403	0x0193	0xFE6D	.L2_WANA_SKAL	REAL	SP bargraph
379	0x017B	0xFE85	.L2_WCOMPUTER	REAL	Computer target setpoint
325	0x0145	0xFEBB	.L2_WDIGI	REAL	Current setpoint
417	0x01A1	0xFE5F	.L2_WEXT	REAL	External setpoint
1882	0x075A	0xF8A6	.L2_WEXT_AKTIV	BOOL	External SP active
381	0x017D	0xFE83	.L2_WSOLL0	REAL	Target setpoint 1
383	0x017F	0xFE81	.L2_WSOLL1	REAL	Target setpoint 2
385	0x0181	0xFE7F	.L2_WSOLL2	REAL	Target setpoint 3
387	0x0183	0xFE7D	.L2_WSOLL3	REAL	Target setpoint 4
841	0x0349	0xFCB7	.L2_WW	REAL	Effective setpoint
317	0x013D	0xFEC3	.L2_XANA	REAL	
401	0x0191	0xFE6F	.L2_XANA_SKAL	REAL	PV bargraph
845	0x034D	0xFCB3	.L2_XDIGI	REAL	Digital display PV
849	0x0351	0xFCAF	.L2_XW	REAL	Control deviation in engineering units
337	0x0151	0xFEAF	.L2_XW_EU	REAL	Control deviation in engineering units
339	0x0153	0xFEAD	.L2_XW_PRZ	REAL	Control deviation in %
357	0x0165	0xFE9B	.L2_Y0_STEUER	REAL	Effective operating point [%]
405	0x0195	0xFE6B	.L2_YCOMPUTER	REAL	OUT COMPUTER with DDC
347	0x015B	0xFEA5	.L2_YHAND	REAL	Man. value of output variable
341	0x0155	0xFEAB	.L2_YMAX	REAL	Max. output value
411	0x019B	0xFE65	.L2_YMAX_BR	REAL	Override selection for override controller
415	0x019F	0xFE61	.L2_YMAX_HR	REAL	Override selection for master controller, MIN. selection
343	0x0157	0xFEA9	.L2_YMIN	REAL	Min. output value
409	0x0199	0xFE67	.L2_YMIN_BR	REAL	OUT-Min override selection for override controller
413	0x019D	0xFE63	.L2_YMIN_HR	REAL	Override selection for master controller, MAX. selection
369	0x0171	0xFE8F	.L2_YSRUECK	REAL	Position feedback
313	0x0139	0xFEC7	.L2_YTRACK	REAL	OUT tracking signal in AUTO mode
1796	0x0704	0xF8FC	.SLH_LOOP2	BOOL	Loop 2 in display
797	0x031D	0xFCE3	.WW_LOOP2	INT	Index of selected setpoint loop 2

Loop 3

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
527	0x020F	0xFDF1	.INDS_LOOP3	INT	Display loop position
1904	0x0770	0xF890	.L3_C_VORB	BOOL	CASCADE mode ready
1902	0x076E	0xF892	.L3_A_VORB	BOOL	AUTOMATIC mode ready
545	0x0221	0xFDDF	.L3_ANA_LO	REAL	Lower bargraph scaling
547	0x0223	0xFDDD	.L3_ANA_HI	REAL	Upper bargraph scaling
1901	0x076D	0xF893	.L3_B1	BOOL	Change-overES1/ES2
525	0x020D	0xFDF3	.L3_BA_YOUT	REAL	Output variable feedback signal
1905	0x0771	0xF88F	.L3_BETART_UM	BOOL	Request mode change-over
867	0x0363	0xFC9D	.L3_D	REAL	Signal for D of PID
591	0x024F	0xFDB1	.L3_D1	DINT	Free DINT variable
593	0x0251	0xFDAF	.L3_D2	DINT	Free DINT variable
595	0x0253	0xFDAD	.L3_D3	DINT	Free DINT variable
597	0x0255	0xFDAB	.L3_D4	DINT	Free DINT variable
451	0x01C3	0xFE3D	.L3_ES1	REAL	1st. input of input circuit
453	0x01C5	0xFE3B	.L3_ES2	REAL	2nd. input of input circuit
455	0x01C7	0xFE39	.L3_ES3	REAL	3rd. input of input circuit
457	0x01C9	0xFE37	.L3_ES4	REAL	4th. input of input circuit
459	0x01CB	0xFE35	.L3_ES5	REAL	5th. input of input circuit
1914	0x077A	0xF886	.L3_GW1_OUT	BOOL	Violation of limit value L3-LV1
1915	0x077B	0xF885	.L3_GW2_OUT	BOOL	Violation of limit value L3-LV2
1916	0x077C	0xF884	.L3_GW3_OUT	BOOL	Violation of limit value L3-LV3
1917	0x077D	0xF883	.L3_GW4_OUT	BOOL	Violation of limit value L3-LV4
1909	0x0775	0xF88B	.L3_HAND_M	BOOL	Step output MORE
1910	0x0776	0xF88A	.L3_HAND_W	BOOL	Step output LESS
477	0x01DD	0xFE23	.L3_K1	REAL	Evaluation factor K1
479	0x01DF	0xFE21	.L3_K2	REAL	Evaluation factor K2
481	0x01E1	0xFE1F	.L3_K3	REAL	Evaluation factor K3
483	0x01E3	0xFE1D	.L3_K4	REAL	Evaluation factor K4
991	0x03DF	0xFC21	.L3_K5	REAL	Evaluation factor K5
993	0x03E1	0xFC1F	.L3_K6	REAL	Evaluation factor K6
995	0x03E3	0xFC1D	.L3_K7	REAL	Evaluation factor K7
997	0x03E5	0xFC1B	.L3_K8	REAL	Evaluation factor K8
999	0x03E7	0xFC19	.L3_K9	REAL	Evaluation factor K9
1001	0x03E9	0xFC17	.L3_K10	REAL	Evaluation factor K10
1003	0x03EB	0xFC15	.L3_K11	REAL	Evaluation factor K11
1005	0x03ED	0xFC13	.L3_K12	REAL	Evaluation factor K12
1007	0x03EF	0xFC11	.L3_K13	REAL	Evaluation factor K13
1009	0x03F1	0xFC0F	.L3_K14	REAL	Evaluation factor K14
1011	0x03F3	0xFC0D	.L3_K15	REAL	Evaluation factor K15
1013	0x03F5	0xFC0B	.L3_K16	REAL	Evaluation factor K16
499	0x01F3	0xFE0D	.L3_KP_STEUER	REAL	Effective P-gain
501	0x01F5	0xFE0B	.L3_KS_STEUER	REAL	Effective amplification constant Ks
549	0x0225	0xFDDB	.L3_LAMBDA	REAL	
1903	0x076F	0xF891	.L3_M_VORB	BOOL	MAN mode ready
1920	0x0780	0xF880	.L3_MAN_AUTO	BOOL	Controller in AUTO or MAN mode
1921	0x0781	0xF87F	.L3_MAN_CAS	BOOL	Controller in CASCADE or MAN mode
515	0x0203	0xFDFD	.L3_PID_D_OUT	REAL	D-portion of output signal
513	0x0201	0xFDFF	.L3_PID_I_OUT	REAL	I-portion of output signal
1918	0x077E	0xF882	.L3_PID_PS	BOOL	Change-over parameter set 1<->2
871	0x0367	0xFC99	.L3_PID_Y_OUT	REAL	Cont. output signal
571	0x023B	0xFDC5	.L3_R1	REAL	Free REAL variable
573	0x023D	0xFDC3	.L3_R2	REAL	Free REAL variable
575	0x023F	0xFDC1	.L3_R3	REAL	Free REAL variable
577	0x0241	0xFDBF	.L3_R4	REAL	Free REAL variable
579	0x0243	0xFDBD	.L3_R5	REAL	Free REAL variable
581	0x0245	0xFDBB	.L3_R6	REAL	Free REAL variable
583	0x0247	0xFDB9	.L3_R7	REAL	Free REAL variable
585	0x0249	0xFDB7	.L3_R8	REAL	Free REAL variable
1906	0x0772	0xF88E	.L3_REGLER_AUTO	BOOL	Controller AUTO
1908	0x0774	0xF88C	.L3_REGLER_C	BOOL	Controller CASCADE
1907	0x0773	0xF88D	.L3_REGLER_MAN	BOOL	Controller MAN
521	0x0209	0xFDF7	.L3_SCAL_LO	REAL	Lower control loop scaling
523	0x020B	0xFDF5	.L3_SCAL_HI	REAL	Upper control loop scaling
1924	0x0784	0xF87C	.L3_SETZ_AUTO	BOOL	Change-over to automatic mode
1925	0x0785	0xF87B	.L3_SETZ_CASC	BOOL	Change-over to cascade mode

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1923	0x0783	0xF87D	.L3_SETZ_MAN	BOOL	Change-over to man. mode
1051	0x041B	0xFBE5	.L3_SETZ_W	INT	Change-over to setpoint source
569	0x0239	0xFDC7	.L3_SKALV	REAL	Scaling factor ratio with LOAD AIR
1919	0x077F	0xF881	.L3_SPAKTIV	BOOL	Auto-configuration active
587	0x024B	0xFDB5	.L3_T1	DINT	Free time variable
511	0x01FF	0xFE01	.L3_T1_STEUER	REAL	Effective delay time T1
589	0x024D	0xFDB3	.L3_T2	DINT	Free time variable
495	0x01EF	0xFE11	.L3_TIME_DPS_MAN	DINT	Step output increment [ms]
503	0x01F7	0xFE09	.L3_TN_STEUER	REAL	Effective integral action time [min]
509	0x01FD	0xFE03	.L3_TT_STEUER	REAL	Effective dead time Tt [min]
505	0x01F9	0xFE07	.L3_TV_STEUER	REAL	Effective derivative action time [min]
541	0x021D	0xFDE3	.L3_V	REAL	Setpoint ratio
1913	0x0779	0xF887	.L3_V_F	BOOL	Fixed value/ratio status
543	0x021F	0xFDE1	.L3_VISTDIGI	REAL	Actual ratio
557	0x022D	0xFDD3	.L3_W_FOLGE	REAL	Setpoint for slave control in cascade
1912	0x0778	0xF888	.L3_W_STATUS	BOOL	
863	0x035F	0xFCA1	.L3_WAKT	REAL	Current setpoint
473	0x01D9	0xFE27	.L3_WANA	REAL	
553	0x0229	0xFDD7	.L3_WANA_SKAL	REAL	SP bargraph
529	0x0211	0xFDEF	.L3_WCOMPUTER	REAL	Computer target setpoint %
475	0x01DB	0xFE25	.L3_WDIGI	REAL	Current setpoint
567	0x0237	0xFDC9	.L3_WEXT	REAL	External setpoint
1922	0x0782	0xF87E	.L3_WEXT_AKTIV	BOOL	External SP active
531	0x0213	0xFDED	.L3_WSOLL0	REAL	Target setpoint 1
533	0x0215	0xFDEB	.L3_WSOLL1	REAL	Target setpoint 2
535	0x0217	0xFDE9	.L3_WSOLL2	REAL	Target setpoint 3
537	0x0219	0xFDE7	.L3_WSOLL3	REAL	Target setpoint 4
861	0x035D	0xFCA3	.L3_WW	REAL	Effective setpoint
467	0x01D3	0xFE2D	.L3_XANA	REAL	
551	0x0227	0xFDD9	.L3_XANA_SKAL	REAL	PV bargraph
865	0x0361	0xFC9F	.L3_XDIGI	REAL	Digital display PV
869	0x0365	0xFC9B	.L3_XW	REAL	Control deviation in engineering units
487	0x01E7	0xFE19	.L3_XW_EU	REAL	Control deviation in engineering units
489	0x01E9	0xFE17	.L3_XW_PRZ	REAL	Control deviation in %
507	0x01FB	0xFE05	.L3_Y0_STEUER	REAL	Effective operating point [%]
555	0x022B	0xFDD5	.L3_YCOMPUTER	REAL	OUT COMPUTER with DDC
497	0x01F1	0xFE0F	.L3_YHAND	REAL	Man. value of output variable
491	0x01EB	0xFE15	.L3_YMAX	REAL	Max. output value
561	0x0231	0xFDCF	.L3_YMAX_BR	REAL	Override selection for override controller
565	0x0235	0xFDCB	.L3_YMAX_HR	REAL	Override selection for master controller, MIN. selection
493	0x01ED	0xFE13	.L3_YMIN	REAL	Min. output value
559	0x022F	0xFDD1	.L3_YMIN_BR	REAL	OUT-Min override selection for override controller
563	0x0233	0xFDCD	.L3_YMIN_HR	REAL	Override selection for master controller, MAX. selection
519	0x0207	0xFDF9	.L3_YSRUECK	REAL	Position feedback
463	0x01CF	0xFE31	.L3_YTRACK	REAL	OUT tracking signal in AUTO mode
1797	0x0705	0xF8FB	.SLH_LOOP3	BOOL	Loop 3 in display
798	0x031E	0xFCE2	.WW_LOOP3	INT	Index of selected setpoint loop 3

Loop 4

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
677	0x02A5	0xFD5B	.INDS_LOOP4	INT	Display loop position
1942	0x0796	0xF86A	.L4_A_VORB	BOOL	AUTOMATIC mode ready
695	0x02B7	0xFD49	.L4_ANA_LO	REAL	Lower bargraph scaling
697	0x02B9	0xFD47	.L4_ANA_HI	REAL	Upper bargraph scaling
1941	0x0795	0xF86B	.L4_B1	BOOL	Change-over ES1/ES2
675	0x02A3	0xFD5D	.L4_BA_YOUT	REAL	Output variable feedback signal
1945	0x0799	0xF867	.L4_BETART_UM	BOOL	Request mode change-over
1944	0x0798	0xF868	.L4_C_VORB	BOOL	CASCADE mode ready
887	0x0377	0xFC89	.L4_D	REAL	Signal for D of PID
741	0x02E5	0xFD1B	.L4_D1	DINT	Free DINT variable
743	0x02E7	0xFD19	.L4_D2	DINT	Free DINT variable
745	0x02E9	0xFD17	.L4_D3	DINT	Free DINT variable
747	0x02EB	0xFD15	.L4_D4	DINT	Free DINT variable
601	0x0259	0xFDA7	.L4_ES1	REAL	1st. input of input circuit
603	0x025B	0xFDA5	.L4_ES2	REAL	2nd. input of input circuit
605	0x025D	0xFDA3	.L4_ES3	REAL	3rd. input of input circuit
607	0x025F	0xFDA1	.L4_ES4	REAL	4th. input of input circuit
609	0x0261	0xFD9F	.L4_ES5	REAL	5th. input of input circuit
1954	0x07A2	0xF85E	.L4_GW1_OUT	BOOL	Violation of limit value L4-LV1
1955	0x07A3	0xF85D	.L4_GW2_OUT	BOOL	Violation of limit value L4-LV2
1956	0x07A4	0xF85C	.L4_GW3_OUT	BOOL	Violation of limit value L4-LV3
1957	0x07A5	0xF85B	.L4_GW4_OUT	BOOL	Violation of limit value L4-LV4
1949	0x079D	0xF863	.L4_HAND_M	BOOL	Step output MORE
1950	0x079E	0xF862	.L4_HAND_W	BOOL	Step output LESS
627	0x0273	0xFD8D	.L4_K1	REAL	Evaluation factor K1
629	0x0275	0xFD8B	.L4_K2	REAL	Evaluation factor K2
631	0x0277	0xFD89	.L4_K3	REAL	Evaluation factor K3
633	0x0279	0xFD87	.L4_K4	REAL	Evaluation factor K4
1015	0x03F7	0xFC09	.L4_K5	REAL	Evaluation factor K5
1017	0x03F9	0xFC07	.L4_K6	REAL	Evaluation factor K6
1019	0x03FB	0xFC05	.L4_K7	REAL	Evaluation factor K7
1021	0x03FD	0xFC03	.L4_K8	REAL	Evaluation factor K8
1023	0x03FF	0xFC01	.L4_K9	REAL	Evaluation factor K9
1025	0x0401	0xFBFF	.L4_K10	REAL	Evaluation factor K10
1027	0x0403	0xFBFD	.L4_K11	REAL	Evaluation factor K11
1029	0x0405	0xFBFB	.L4_K12	REAL	Evaluation factor K12
1031	0x0407	0xFBF9	.L4_K13	REAL	Evaluation factor K13
1033	0x0409	0xFBF7	.L4_K14	REAL	Evaluation factor K14
1035	0x040B	0xFBF5	.L4_K15	REAL	Evaluation factor K15
1037	0x040D	0xFBF3	.L4_K16	REAL	Evaluation factor K16
649	0x0289	0xFD77	.L4_KP_STEUER	REAL	Effective P-gain
651	0x028B	0xFD75	.L4_KS_STEUER	REAL	Effective amplification constant Ks
699	0x02BB	0xFD45	.L4_LAMBDA	REAL	
1943	0x0797	0xF869	.L4_M_VORB	BOOL	MAN mode ready
1960	0x07A8	0xF858	.L4_MAN_AUTO	BOOL	Controller in AUTO or MAN
1961	0x07A9	0xF857	.L4_MAN_CAS	BOOL	Controller in CASCADE or MAN
665	0x0299	0xFD67	.L4_PID_D_OUT	REAL	D-portion of output signal
663	0x0297	0xFD69	.L4_PID_I_OUT	REAL	I-portion of output signal
1958	0x07A6	0xF85A	.L4_PID_PS	BOOL	Change-over parameter set 1<->2
891	0x037B	0xFC85	.L4_PID_Y_OUT	REAL	Cont. output signal
721	0x02D1	0xFD2F	.L4_R1	REAL	Free REAL variable
723	0x02D3	0xFD2D	.L4_R2	REAL	Free REAL variable
725	0x02D5	0xFD2B	.L4_R3	REAL	Free REAL variable
727	0x02D7	0xFD29	.L4_R4	REAL	Free REAL variable
729	0x02D9	0xFD27	.L4_R5	REAL	Free REAL variable
731	0x02DB	0xFD25	.L4_R6	REAL	Free REAL variable
733	0x02DD	0xFD23	.L4_R7	REAL	Free REAL variable
735	0x02DF	0xFD21	.L4_R8	REAL	Free REAL variable
1946	0x079A	0xF866	.L4_REGLER_AUTO	BOOL	Controller AUTO
1948	0x079C	0xF864	.L4_REGLER_C	BOOL	Controller CASCADE
1947	0x079B	0xF865	.L4_REGLER_MAN	BOOL	Controller MAN
671	0x029F	0xFD61	.L4_SCAL_LO	REAL	Lower control loop scaling
673	0x02A1	0xFD5F	.L4_SCAL_HI	REAL	Upper control loop scaling
1964	0x07AC	0xF854	.L4_SETZ_AUTO	BOOL	Change-over to automatic mode
1965	0x07AD	0xF853	.L4_SETZ_CASC	BOOL	Change-over to cascade mode

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
1963	0x07AB	0xF855	.L4_SETZ_MAN	BOOL	Change-over to man. mode
1052	0x041C	0xFBE4	.L4_SETZ_W	INT	Change-over to setpoint source
719	0x02CF	0xFD31	.L4_SKALV	REAL	Scaling factor ratio with LOAD AIR
1959	0x07A7	0xF859	.L4_SPAKTIV	BOOL	Auto-configuration active
737	0x02E1	0xFD1F	.L4_T1	DINT	Free time variable
661	0x0295	0xFD6B	.L4_T1_STEUER	REAL	Effective delay time T1
739	0x02E3	0xFD1D	.L4_T2	DINT	Free time variable
645	0x0285	0xFD7B	.L4_TIME_DPS_MAN	DINT	Step output increment [ms]
653	0x028D	0xFD73	.L4_TN_STEUER	REAL	Effective integral action time [min]
659	0x0293	0xFD6D	.L4_TT_STEUER	REAL	Effective dead time Tt [min]
655	0x028F	0xFD71	.L4_TV_STEUER	REAL	Effective derivative action time [min]
691	0x02B3	0xFD4D	.L4_V	REAL	Setpoint ratio
1953	0x07A1	0xF85F	.L4_V_F	BOOL	Fixed value/ratio status
693	0x02B5	0xFD4B	.L4_VISTDIGI	REAL	Actual ratio
707	0x02C3	0xFD3D	.L4_W_FOLGE	REAL	Setpoint for slave control in cascade
1952	0x07A0	0xF860	.L4_W_STATUS	BOOL	
883	0x0373	0xFC8D	.L4_WAKT	REAL	Current setpoint
623	0x026F	0xFD91	.L4_WANA	REAL	
703	0x02BF	0xFD41	.L4_WANA_SKAL	REAL	SP bargraph
679	0x02A7	0xFD59	.L4_WCOMPUTER	REAL	Computer target setpoint
625	0x0271	0xFD8F	.L4_WDIGI	REAL	Current setpoint
717	0x02CD	0xFD33	.L4_WEXT	REAL	External setpoint
1962	0x07AA	0xF856	.L4_WEXT_AKTIV	BOOL	External SP active
681	0x02A9	0xFD57	.L4_WSOLL0	REAL	Target setpoint 1
683	0x02AB	0xFD55	.L4_WSOLL1	REAL	Target setpoint 2
685	0x02AD	0xFD53	.L4_WSOLL2	REAL	Target setpoint 3
687	0x02AF	0xFD51	.L4_WSOLL3	REAL	Target setpoint 4
881	0x0371	0xFC8F	.L4_WW	REAL	Effective setpoint
617	0x0269	0xFD97	.L4_XANA	REAL	
701	0x02BD	0xFD43	.L4_XANA_SKAL	REAL	PV bargraph
885	0x0375	0xFC8B	.L4_XDIGI	REAL	Digital display PV
889	0x0379	0xFC87	.L4_XW	REAL	Control deviation in engineering units
637	0x027D	0xFD83	.L4_XW_EU	REAL	Control deviation in engineering units
639	0x027F	0xFD81	.L4_XW_PRZ	REAL	Control deviation in %
657	0x0291	0xFD6F	.L4_Y0_STEUER	REAL	Effective operating point [%]
705	0x02C1	0xFD3F	.L4_YCOMPUTER	REAL	OUT COMPUTER with DDC
647	0x0287	0xFD79	.L4_YHAND	REAL	Man. value of output variable
641	0x0281	0xFD7F	.L4_YMAX	REAL	Max. output value
711	0x02C7	0xFD39	.L4_YMAX_BR	REAL	Override selection for override controller
715	0x02CB	0xFD35	.L4_YMAX_HR	REAL	Override selection for master controller, MIN. selection
643	0x0283	0xFD7D	.L4_YMIN	REAL	Min. output value
709	0x02C5	0xFD3B	.L4_YMIN_BR	REAL	OUT-Min override selection for override controller
713	0x02C9	0xFD37	.L4_YMIN_HR	REAL	Override selection for master controller, MAX. selection
669	0x029D	0xFD63	.L4_YSRUECK	REAL	Position feedback
613	0x0265	0xFD9B	.L4_YTRACK	REAL	OUT tracking signal in AUTO mode
1798	0x0706	0xF8FA	.SLH_LOOP4	BOOL	Loop 4 in display
799	0x031F	0xFCE1	.WW_LOOP4	INT	Index of selected setpoint loop 4

Others

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
800	0x0320	0xFCE0	.A_LOOP	INT	Displayed loop
1814	0x0716	0xF8EA	.CAS_TRACK	BOOL	Master controller tracking in cascade
1812	0x0714	0xF8EC	.COMAKTIV	BOOL	MODBUS-communication without time-out
1808	0x710	0xF8F0	.DPAKTIV	BOOL	DP communication is running
1802	0x070A	0xF8F6	.FLAG_1	BOOL	Binary flag 1
1803	0x070B	0xF8F5	.FLAG_2	BOOL	Binary flag 2
1804	0x070C	0xF8F4	.FLAG_3	BOOL	Binary flag 3
1805	0x070D	0xF8F3	.FLAG_4	BOOL	Binary flag 4
1806	0x070E	0xF8F2	.FLAG_5	BOOL	Binary flag 5
1807	0x070F	0xF8F1	.FLAG_6	BOOL	Binary flag 6
903	0x0387	0xFC79	.INT_01	INT	Free INT variable for comm.
904	0x0388	0xFC78	.INT_02	INT	Free INT variable for comm.
905	0x0389	0xFC77	.INT_03	INT	Free INT variable for comm.
906	0x038A	0xFC76	.INT_04	INT	Free INT variable for comm.
907	0x038B	0xFC75	.INT_05	INT	Free INT variable for comm.
908	0x038C	0xFC74	.INT_06	INT	Free INT variable for comm.
909	0x038D	0xFC73	.INT_07	INT	Free INT variable for comm.
910	0x038E	0xFC72	.INT_08	INT	Free INT variable for comm.
911	0x038F	0xFC71	.INT_09	INT	Free INT variable for comm.
912	0x0390	0xFC70	.INT_10	INT	Free INT variable for comm.
913	0x0391	0xFC6F	.INT_11	INT	Free INT variable for comm.
914	0x0392	0xFC6E	.INT_12	INT	Free INT variable for comm.
915	0x0393	0xFC6D	.INT_13	INT	Free INT variable for comm.
916	0x0394	0xFC6C	.INT_14	INT	Free INT variable for comm.
917	0x0395	0xFC6B	.INT_15	INT	Free INT variable for comm.
918	0x0396	0xFC6A	.INT_16	INT	Free INT variable for comm.
919	0x0397	0xFC69	.INT_17	INT	Free INT variable for comm.
920	0x0398	0xFC68	.INT_18	INT	Free INT variable for comm.
921	0x0399	0xFC67	.INT_19	INT	Free INT variable for comm.
922	0x039A	0xFC66	.INT_20	INT	Free INT variable for comm.
923	0x039B	0xFC65	.INT_21	INT	Free INT variable for comm.
924	0x039C	0xFC64	.INT_22	INT	Free INT variable for comm.
925	0x039D	0xFC63	.INT_23	INT	Free INT variable for comm.
926	0x039E	0xFC62	.INT_24	INT	Free INT variable for comm.
927	0x039F	0xFC61	.INT_25	INT	Free INT variable for comm.
928	0x03A0	0xFC60	.INT_26	INT	Free INT variable for comm.
929	0x03A1	0xFC5F	.INT_27	INT	Free INT variable for comm.
930	0x03A2	0xFC5E	.INT_28	INT	Free INT variable for comm.
931	0x03A3	0xFC5D	.INT_29	INT	Free INT variable for comm.
932	0x03A4	0xFC5C	.INT_30	INT	Free INT variable for comm.
933	0x03A5	0xFC5B	.INT_31	INT	Free INT variable for comm.
934	0x03A6	0xFC5A	.INT_32	INT	Free INT variable for comm.
812	0x032C	0xFCD4	.LATERAL1	INT	Status of lat. comm. No.1
813	0x032D	0xFCD3	.LATERAL2	INT	Status of lat. comm. No. 2
814	0x032E	0xFCD2	.LATERAL3	INT	Status of lat. comm. No. 3
815	0x032F	0xFCD1	.LATERAL4	INT	Status of lat. comm. No. 4
816	0x0330	0xFCD0	.LATERAL5	INT	Status of lat. comm. No. 5
817	0x0331	0xFCCF	.LATERAL6	INT	Status of lat. comm. No. 6
811	0x032B	0xFCD5	.LATERALNR	INT	Lat. comm. address
1811	0x0713	0xF8ED	.MACCOUNT	BOOL	Change-over of mode under prep.
935	0x03A7	0xFC59	.MOD0ERR	INT	Error of basic IO unit
936	0x03A8	0xFC58	.MOD1ERR	INT	Error in module 1
937	0x03A9	0xFC57	.MOD2ERR	INT	Error in module 2
938	0x03AA	0xFC56	.MOD3ERR	INT	Error in module 3
939	0x03AB	0xFC55	.MOD4ERR	INT	Error in module 4
940	0x03AC	0xFC54	.MOD5ERR	INT	Error in module 5
941	0x03AD	0xFC53	.MOD6ERR	INT	Error in module 6
942	0x03AE	0xFC52	.MOD7ERR	INT	Error in module 7
1043	0x0413	0xFBED	.NEU_DATUM	DINT	Sync. time
1810	0x0712	0xF8EE	.PG_BETRIEB	BOOL	Start of program source
805	0x0325	0xFCDB	.PG_LAUF	DINT	Run time of active program
1045	0x0415	0xFBEB	.PG_NLAUF	DINT	Net run time of active program
801	0x0321	0xFCDF	.PG_NR_AKT	INT	Program number of active program
803	0x0323	0xFCDD	.PG_NR_SEL	INT	Program number of selected program
1815	0x0717	0xF8E9	.PG_RESET	BOOL	Setpoint generator reset

Decimal	Read hexadecimal	Write hexadecimal	Variable name	Data type	Comment
802	0x0322	0xFCDE	.PG_SCHNELL	INT	Fast forward/backward
804	0x0324	0xFCDC	.PG_SEG	INT	Segment number of active program
1047	0x0417	0xFBE9	.PG_SEGZEIT	DINT	Run time in segment of PS
1053	0x041D	0xFBE3	.PG_ZYKLEN	INT	Processed loops of PS
1799	0x0707	0xF8F9	.POS_WW	BOOL	IND-Loop indicates effective setpoint
1800	0x0708	0xF8F8	.POS_Y	BOOL	IND-Loop indicates output value
1817	0x0719	0xF8E7	.PRG_BA1	BOOL	Binary track 1 of program source
1818	0x071A	0xF8E6	.PRG_BA2	BOOL	Binary track 2 of setpoint generator
1819	0x071B	0xF8E5	.PRG_BA3	BOOL	Binary track 3 of setpoint generator
1820	0x071C	0xF8E4	.PRG_BA4	BOOL	Binary track 4 of setpoint generator
1816	0x0718	0xF8E8	.PRG_ENDE	BOOL	Active program terminated
1801	0x0709	0xF8F7	.REMOTE	BOOL	Remote control of controller via RS-232/485
1039	0x040F	0xFBF1	.RTC_DATUM	DINT	Date and time [s]
1055	0x041F	0xFBE1	.RTC_ERROR	INT	Clock error
1054	0x041E	0xFBE2	.RTC_STATUS	INT	Clock state
1041	0x0411	0xFBEF	.RTC_ZEIT	DINT	Time [msec]
1809	0x711	0xF8EF	.SETZ_DATUM	BOOL	Set time
1791	0x06FF	0xF901	.STEPS_B	BOOL	IND-loop backwards
1792	0x0700	0xF900	.STEPS_F	BOOL	IND-loop forwards
1794	0x0702	0xF8FE	.STEPW_F	BOOL	SP-W-loop forwards
751	0x02EF	0xFD11	.TAB01	REAL	Output table 1
753	0x02F1	0xFD0F	.TAB02	REAL	Output table 2
755	0x02F3	0xFD0D	.TAB03	REAL	Output table 3
757	0x02F5	0xFD0B	.TAB04	REAL	Output table 4
807	0x0327	0xFCD9	.W_P	REAL	Ramp setpoint of setpoint generator
1813	0x0715	0xF8EB	.WW_UM	BOOL	
771	0x0303	0xFCFD	.ZK01	REAL	Output status correction 1
773	0x0305	0xFCFB	.ZK02	REAL	Output status correction 2
901	0x0385	0xFC7B	Tastatur	INT	Keyboard remote control

Packaging for Transport or for Return to the Manufacturer

-If the original packaging material is no longer available, wrap the module in a padded plastic film or corrugated paper board. Put the wrapped device in a box laid out with a damping material like foamed plastics. The thickness of the damping material should be in accordance with the device weight and the type of transportation.-- Label the box with a "handle with care" sticker.

For overseas shipping always add a desiccant bag (e.g. filled with silica gel) and then weld the device in a 0.2 mm polyethylene foil. Adapt the amount of desiccant to the packing- volume and the approximate transportation time (at least 3 months). Additionally line the box with a layer of union paper.-

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