

User's manual DD6000 controller

controller for the OSENET network

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INTRODUCTION

The DD6000 network controller for OSENET allows multiple DD6000 decoders to be connected to a single host computer. The controller transposes the data streams coming from the decoders into a single data stream which can be accepted by the host computer. Conversely, messages coming from the host and intended for a decoder have to pass the controller. Both host-controller and controller-decoder communication has to take place according to certain rules: the data link protocol. These protocols take care of the integrity of the communication between the devices.

The controller is thus concerned with two separate data links: one which connects it to the DD6000s, and one which connects it to the host. The first data link is described in part 3. The latter data link is described in part 4. In order to better comprehend the features of OSENET, it is recommended to read the manual "*User's manual DD6000*" before reading this manual.

The OSENET system allows for high speed data transmission across both data links. The default baud rate for decoder-controller communication is 125Kbps. The DD6000 network controller supports two standard hardware interfaces for controller-host communication: RS232 and RS422/RS485. The latter is extremely useful for network applications because it is less sensible to noise.

Both data link protocols are user programmable via bar code menus. The adjustable parameters are stored in a non-volatile memory, so they remain present even when the device is switched off.

This manual contains the following parts:

1. THE DD6000 NETWORK CONTROLLER

The DD6000 network controller is an interface control device used to transpose data, coming from a number of decoders, into a data stream suited for the host computer. Mechanical features of the controller, shown in this part, are very similar to the features of the DD6000 decoder. This part also describes technical specifications of both soft-

ware and hardware of the controller.

2. OSENET NETWORK EQUIPMENT

OSENET is a full duplex, multidrop RS485 connection, allowing the connection of several stations to a shared host device. Up to 126 decoder stations can be connected. This section describes the installation and setup of the network. Guidelines, in case non-standard cable work is used, are indicated here. Moreover, some features of both controller-decoders and host-controller communication are shown.

3. THE OSENET SYSTEM

Data exchange across the network has to be managed according to certain rules; the OSEnet protocol. In the first section of this part the protocol is analysed. In part 5 the information about the protocol will be used to calculate the response time of the network. In the second section bar code menus are present, which allows you to program some features of the network.

4. CONTROLLER-HOST COMMUNICATION PROTOCOL

This section describes the communication between the controller and the host.

5. TIME ANALYSIS OF OSENET

In this section formulas are derived to calculate the response time for your specific network. Figures help you to get a good impression of the speed of the network. The guidelines indicated at the end of the section should be followed if the response time turns out to be too long.

APPENDICES

- **Appendix A** describes the pin configuration of the ports of the controller.
- **Appendix B** contains a table with read direct bar code labels.
- **Appendix C** features a listing of a BASIC program to calculate the response time for your network.
- **Appendix D** is the trouble shoot section.
- **Appendix E** contains a glossary of terms in which technical terms are explained.

LIST OF ABBREVIATIONS

A:	Ampere (unit of Current)
AC:	Alternating Current
ACK:	Acknowledge (ASCII-symbol 06h)
ANSI:	American National Standards Institute
ASCII:	American Standard for Code Information Interchange
CISPR:	French initials for the International Special Committee on Radio Interference
CR:	Carriage Return (ASCII-symbol 0Dh)
CTS:	Clear to Send
D:	Depth
DC:	Direct Current
DCD:	Data Carrier Detect
DCE:	Data Communications Equipment
DLE:	Data Link Escape (ASCII-symbol 10h)
DOS:	Disk Operating System
DSR:	Data Set Ready
DTE:	Data Terminating Equipment
DTR:	Data Terminal Ready
EMC:	Electro Magnetic Compatibility
ENQ:	Enquiry (ASCII-symbol 05h)

EOP:	End of Poll
EOT:	End of Transmission (ASCII-symbol 04h)
ESD:	Electro Static Discharge
ETX:	End of Text (ASCII-symbol 03h)
f:	Frequency
FF:	Form feed (ASCII-symbol 0Ch)
FS:	File separator (ASCII-symbol 1Ch)
GS:	Group separator (ASCII-symbol 1Dh)
ID:	Identification
IEC:	International Electrotechnical Commission
ISO:	International Standards Organisation
L:	Length
LCD:	Liquid Crystal Display
LED:	Light Emitting Diode
LF:	Line Feed (ASCII-symbol 0Ah)
LRC:	Longitudinal Redundancy Check
NAK:	Not Acknowledged (ASCII-symbol 15h)
OSENET:	Opticon Sensors Europe Network
OSI:	Open Systems Interconnection
PC:	Personal Computer
RAM:	Random Access Memory
ROM:	Read Only Memory
RI:	Ring Indicator
RS:	Recommended Standard

RS:	Record separator (ASCII-symbol 1Eh)
RTS:	Request to Send
RxD:	Received Data
SOH:	Start of Heading (ASCII-symbol 01h)
STX:	Start of Text (ASCII-symbol 02h)
TTL:	Transistor Transistor Logic
TxD:	Transmitted Data
V:	Volt (unit of potential)
W:	Width



the DD6000 network controller

Remove the system components from their packing and inspect them for any evidence of physical damage. If the shipping container shows external damage and the controller does not operate properly, get in contact with the shipping firm for a claim. Keep the packing: It should be used whenever the controller is transported for servicing. Damage caused by improper repacking is not covered by the warranty. At any time the following components should be present:

- this manual
- the DD6000 network controller
- 5 Volt DC power supply

For the network, Opticon can either deliver standard cabling resources or meet the needs of the customer.

In this part mechanical features and technical specifications of the DD6000 controller will be described. A description of how to install the network is given in part 2, "OSENET network equipment".

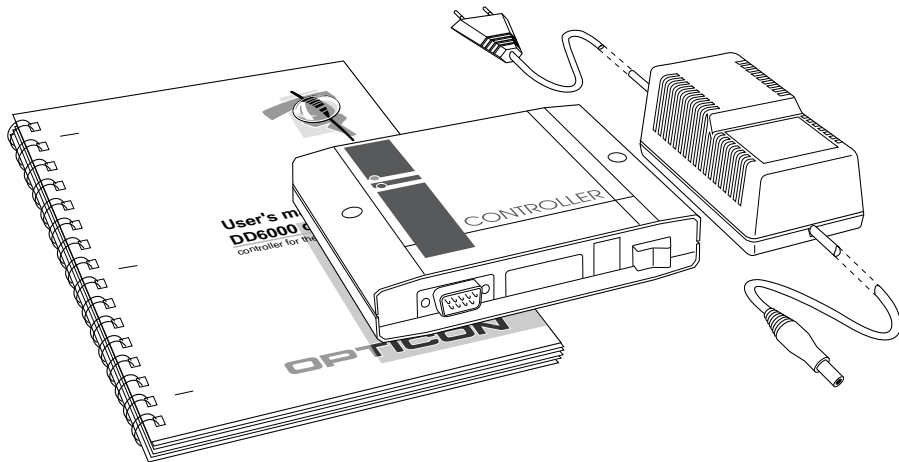
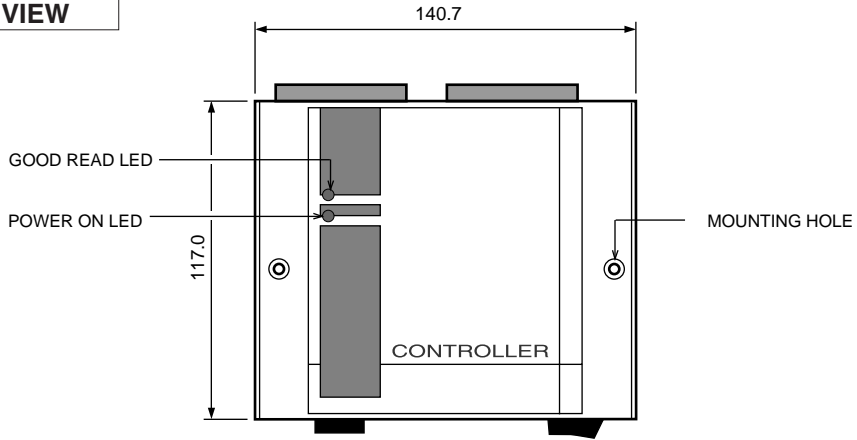


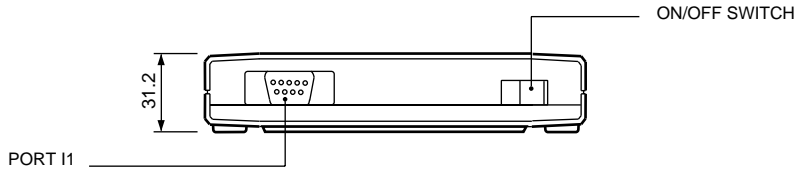
Figure 1.1 Components present in packing of DD6000 network controller.

1.1 MECHANICAL FEATURES

TOP VIEW



FRONT VIEW



REAR VIEW

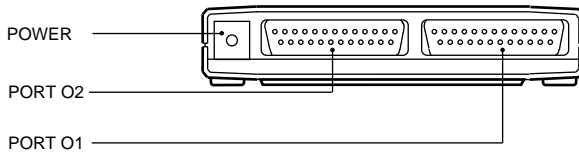


Figure 1.2 Top, front and rear view on the DD6000 network controller.

FEATURE DESCRIPTION

TOP VIEW

good read LED

- Green LED indicates whether the data has been transmitted correctly.

**power on LED
mounting hole**

- Red LED indicates whether the power is on.
- Allows solid mounting in any position.

FRONT VIEW

port I1

- Port for connection of bar code scanning device such as wand or CCD-scanner. With the scanner, bar code labels can be read to set several parameters for OSENET and configuration of the host-controller data link protocol.

REAR VIEW

port O1

- This port should be connected to the host-computer.

port O2

- This port is used for connection to the decoders via the OSENET cabling.

power

- 5 Volt DC power supply.

1.2 TECHNICAL SPECIFICATIONS

HARDWARE AND ELECTRICAL FEATURES

Power supply voltage	5.0 V dc \pm 5 %
Power supply current	150 mA without peripherals attached
Operating temperature	-10° to 70° Celsius (IEC 68-2-1 and IEC 68-2-2)
Storage temperature	-40° to 125° Celsius
Humidity	20%-95% non-condensing
Weight	270 g
Dimensions	LxWxD: 127.0 x 140.7 x 31.2 mm
Vibration	IEC 68-2-6 (5 Hz.<f<55 Hz, Axis 1G(X, Y, Z))
Shock	IEC 68-2-27 (Pulse: half sine, T=18 ms, peak acc. 294 m/s ²)
ESD	IEC 801-2 (up to 10 KV contact discharge)
EMC	CISPR22 (radio interference) - class B IEC 801-3 (radiated EM fields) - class 3 IEC 801-4 (electrical transient/burst) - class 3
Indicators	2 LEDs 1 Buzzer
Memory	256 bytes EEPROM, 32 Kbytes PROM, 130 Kbytes SRAM
Connectors	-Port I1: 9 pins AMP squeeze-to-release male connector -Port O1: DB25 female connector -Port O2: DB25 male connector
Devices supported	-Port I1: wand, CCD -Port O1: host computer -Port O2: DD6000 decoders (via OSENET)
Interfaces	-Port I1: bar code reader -Port O1: RS232, RS422/485 -Port O2: RS485 (OSENET)

The DD6000 network controller can be programmed by scanning bar code labels in the

programmer's guide, with a bar code reader connected to port I1.

PROGRAMMING FEATURES

host-controller communication features:

- baud rate
- handshake protocol
- communication protocol
- interface type
- parity
- number of stop bits

OSENET network features:

- baud rate
- decoder response time
- decoder recovery time
- maximum number of errors before off-line
- number of stations (decoders)
- separate station on/off-line

AND MORE !



2

OSENET network equipment

If a network of decoders is purchased, cable work is necessary to connect the DD6000 decoders to the network controller. Opticon can either deliver standard cable work or meet the needs of the customer. Specifications and guidelines for the cable work are given in section 2.2. Section 2.3 contains detailed instructions for installation of the network. A network not meeting the guidelines and requirements indicated in this section is not guaranteed to work properly. The last section shows you how to start-up the equipment, once the network has been installed.

2.1 CONTROLLER AND DECODERS

In a network configuration decoders and controller are positioned as in figure 2.1.

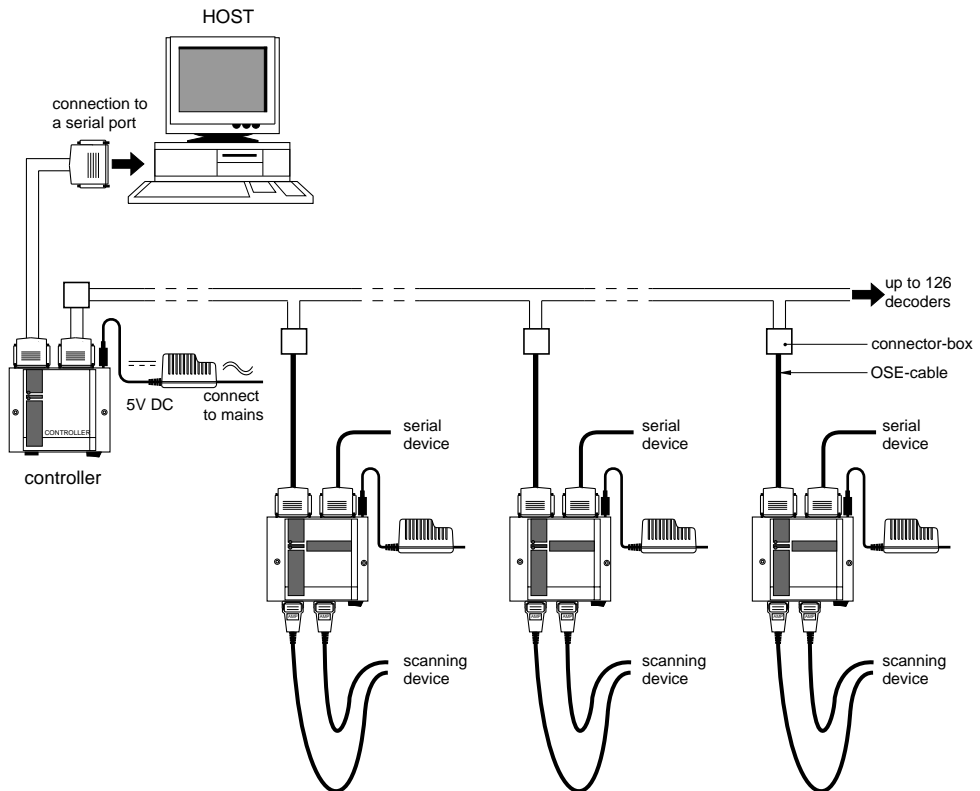


Figure 2.1 Configuration for a network of decoders.

Without repeaters 31 decoders can be connected to the controller. If more than 31 stations are connected to the controller, groups of stations are connected to the controller in a tree-like structure, via repeaters. If a network of decoders (no. decoders <32) is purchased, these are the components that should be present:

- DD6000 decoders
- DD6000 network controller
- cable work (section 2.2)

DD6000 decoders

With each decoder purchased, a power supply and a OSENET-cable are supplied in addition. The OSENET-cable has a DB25 female connector and a 8p8 modular telephone connector. The latter is used to connect port O1 of the decoder to the connector box of the network.

DD6000 network controller

With each controller purchased, a power supply is supplied in addition.

2.2 CABLE WORK

The cable work physically connects the decoders to the controller, which on its turn is connected to the host-computer. Many trade-offs in cable length and interfaces can occur while designing the network. The maximum permitted cable length depends on the interface and cable type used. Three sorts of cables are available:

- OSE-cable, to connect the decoder/controller to the belonging connector box.
- Network cable, or main cable. This cable goes from the connector-box belonging to the controller to the connector-boxes belonging to the decoders.
- Host-controller cable. This cable connects the controller to the host computer.

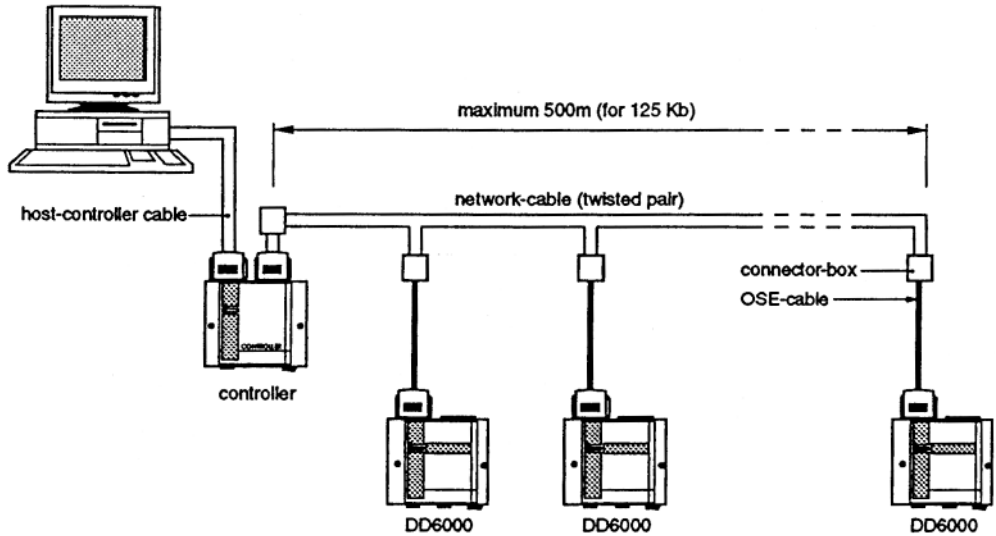


Figure 2.2 Cable-work for the OSENET network.

The OSE-cable

The OSE-cables are used to connect the DD6000 decoder to the connector boxes. You are advised to keep these cables as short as possible. The maximal length of this cable is approximately 2 meters. For longer cables you are advised to use shielded twisted pair cables. A DB25 connector is used to connect the cable to the decoder. For connection to the connector box an 8p8 modular telephone plug is used. Please refer to appendix A for a detailed description of the connectors used.

The network cable or main cable

The maximal permissible length of network cable depends on the transmission speed used. Increasing the cable length means increasing exposure to noise and signal distortion. Therefore, you are advised to restrict the cable length to a minimum. Figure 2.3 gives the data signalling rate versus the cable length for the RS422/485 interface, when a twisted pair cable is used. The value of 500 meter, for a transmission speed of 125 kbps, should be considered to be a very conservative value. Larger cable lengths are probably possible.

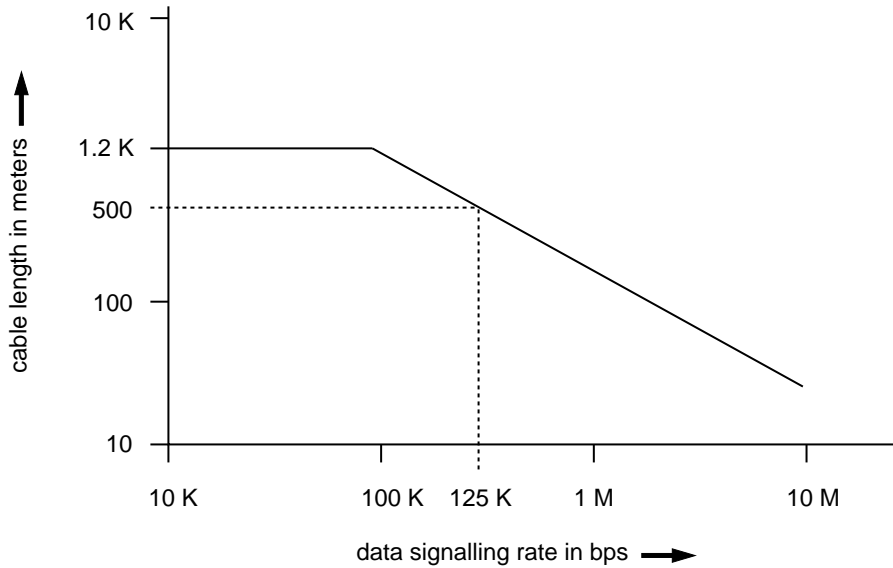


Figure 2.3 Cable length as function of the signalling rate for the RS422/485 interface.

The network cable connects the controller to the decoder via the connector boxes. The dimensions of the connector box, as shown in figure 2.4 are:
L x W x D: 55 x 49 x 20 mm.

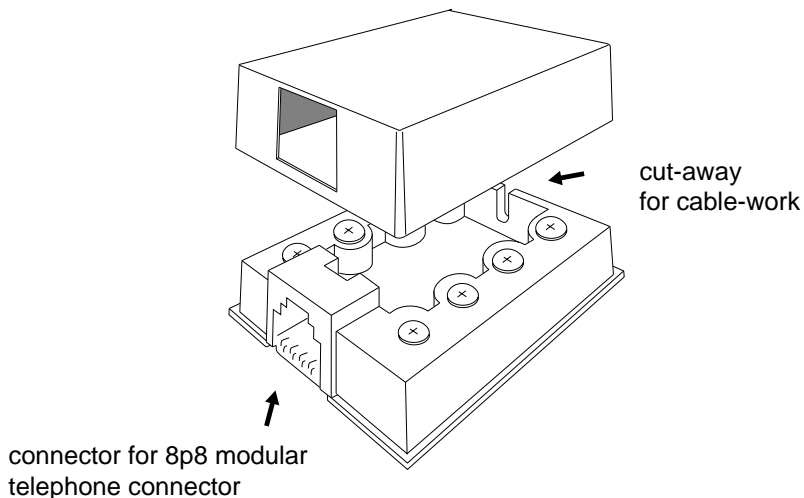
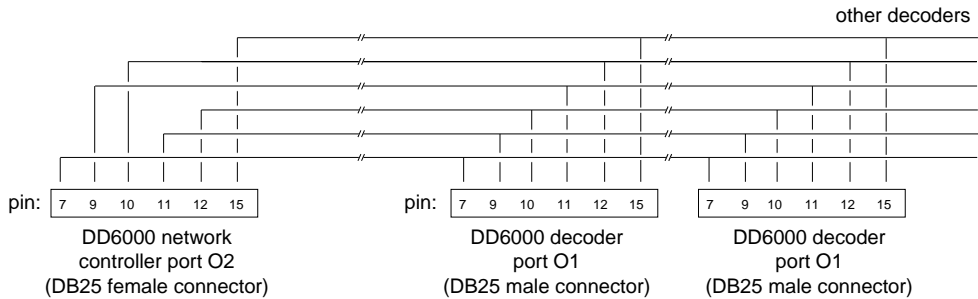


Figure 2.4 Connector box.

At any time the connection should be as indicated in figure 2.5.



connection of pin 15 is optional, it can be used for repeater control

Figure 2.5 Pin connection for OSENET.

In this figure is:

pin 7	- GND	- Logic ground
pin 9	- TR+	- Receive differential voltage
pin 10	- TR-	- Receive differential voltage
pin 11	- T+	- Transmit differential voltage
pin 12	- T-	- Transmit differential voltage
pin 15	- R. C.	- Repeater control

The host-controller cable

The host-controller cable has two DB25 connectors to connect the controller to the host computer. Two interfaces are available: RS232 and RS485. For short distances between host and controller, the RS232 interface with a standard cable can be used. For the relation cable length - data signalling rate for the RS232 interface, please refer to table 2.1. In figure 2.4 this relation is given for the RS485 interface. You are advised to use a twisted pair cable if the cable length is 2 meters or more.

Baudrate (bits per sec)	Max. cable length (meters)
19200	<75
9600	75
4800	150
2400	230

Table 2.1 The relation baud rate - maximum cable length for the RS232 interface.

2.3 INSTALLATION AND SETUP

Once the decoders, controller and additional components have been unpacked, you can start with the installation of the network. Before installing, locate the used decoders, controller and belonging connector boxes, and determine the cabling needed with in the back of your mind the guidelines for the cable work indicated in section 2.2.

To set up the network with standard cable-work, follow these steps:

1. Mount the connector-boxes at an appropriate place.
2. Mount the controller and decoders on a flat surface. The surface may be vertical, horizontal, or any incline in between.
3. Lay the cabling. Connect the cores to the boxes in a way that the connections as shown in figure 2.5 are established.
4. Make sure that all electrical devices to be used are switched off.

5. Connect the DD6000 decoders with a OSENET-cable to the belonging connector box. The OSENET-cable should be connected to port O1 of the decoder. Make sure that the cable is connected properly by screwing tight the connector on the side of the decoder. The modular connector is connected properly if a "click" is heard while attaching it to the connector-box.
6. Connect the controller to the serial port of the host computer, with the host-controller cable. The cable should be connected to port O1 of the controller. Make sure that it is connected properly on both sides, by screwing tight the connectors.
7. Connect the controller with a OSENET-cable to the belonging connector box. The network cable should be connected to port O2 of the controller. Make sure that the cable is connected properly by screwing tight the connector on the side of the controller. The modular connector is connected properly if a "click" is heard while attaching it to the connector-box.
8. Connect devices to the decoders.
9. Use the 5V power supplies to connect both the DD6000s and the network controller to the mains.
10. If all devices are properly connected, the computer can be switched on.
11. Next, the network server and decoders can be turned on with the "on/off switch". (Devices connected to port O2 of the decoders can also be switched on).

The software version and "DD6000 OSENET" will appear on the LCD of the decoders. Up to 126 decoders can be connected to OSENET. If more than 31 stations are connected to the controller, groups of stations are connected in a tree-like structure, via repeaters. Please refer to the manual accompanying the repeater.

If the standard cable work is not used, make sure that the connection between controller and decoders is made according to figure 2.3. In which:

pin 7	- GND	- Logic Ground
pin 9	- TR ⁺	- Receive differential voltage
pin 10	- TR ⁻	- Receive differential voltage
pin 11	- T ⁺	- Transmit differential voltage
pin 12	- T ⁻	- Transmit differential voltage
pin 15	- R. C.	- Repeater Control

Once all devices are properly connected and switched on, the network can be set up. Make sure that the decoders in the network are set on "OSENET" (page 37 of the *"User's manual DD6000"*). A unique station ID (1-126) should be given to each decoder. The station ID can be selected with the Read Direct Labels (pages 109-121 of the *"User's manual DD6000"*).

If parameters of a decoder are set with the cloning option, the station ID should be adjusted afterwards.

The OSENET network protocol features several parameters which can be set. These parameters will be described in part 3 of this manual, *"OSENET network protocol "*.



3

the OSENET system

The OSENET network is a full duplex, multi-drop RS485 connection, allowing the connection of several stations to a shared host device. In a network using OSENET, one unit controls the flow of data across the network: the DD6000 controller, or primary station. All other stations (= DD6000 decoders) attached to the network are secondary stations. Section 3.1 in short describes the data exchange across the network. Sequences for data exchange from the decoders to the controller and in the opposite direction require standard procedures which are always initiated by the controller.

The second section is the programmers part for the OSENET-network. In this section many parameters of the OSENET protocol can be set. Bar code labels are present on each right page, whereas a concise description of the function of the labels can be found on the left page.

3.1 THE OSENET PROTOCOL

The data flow across the network is controlled by the primary station; the DD6000 network controller, as depicted in figure 3.1. The controller interrogates each decoder in turn to see if it wishes to transmit data. This is called polling. A decoder can only transmit data when polled by the controller, data flow 1 in figure 3.1. The data is packed in frames; the OSENET-frame. Apart from the actual data, these frames contain information about the data address, data type, data synchronisation, etc. Data sent by a station is buffered at the controller in order to be sent to the host computer, data flow 3. However, first the controller has to convert the OSENET-frame to a frame suitable for the controller-host data link. The data frame format for the host controller data frame can be configured in part 4, and depends on the program running on the host computer. At the host the data is processed and a response is sent back to the controller, data flow 4. At least this response contains information about the destination of the data. At the controller the data frame is converted back to the OSENET-frame. Finally the controller sends this information to the station in question, data flow 2. Data flow 1 and 2 will be described in this section. The host-controller data link (flow 3 and 4) will extensively be described in part 4 of this manual.

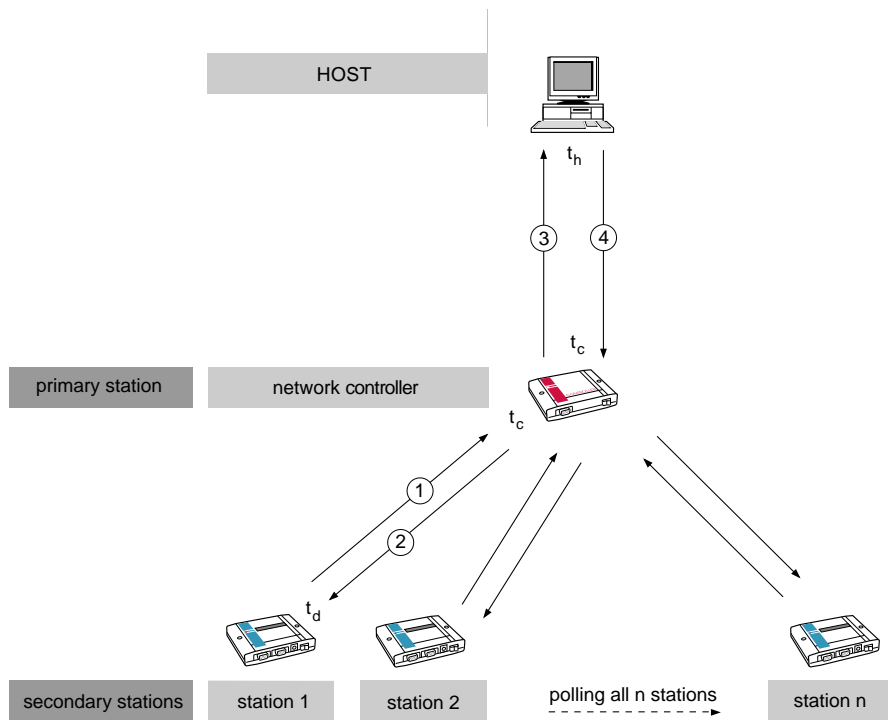


Figure 3.1 Data flows considered for decoder-host communication.

decoder - controller data exchange(data flow 1 in fig. 3.1)

The protocol for sending data from a decoder station to the controller (data flow 1 in figure 3.1) is depicted in table 3.1. After receiving the poll, it takes the decoder station t_d seconds to react with the data. Once all data is received by the controller, it sends back a <RECEIVE READY> , after seconds t_c , to acknowledge the data reception. The t_d and t_c are the turnaround times for the decoder and controller. The t_d is the time it takes for the decoder to process the data (<POLL>) received from the controller and send back a response. The t_c is the time it takes for the controller to process the data received from the decoder and send back a response. For both decoder and controller these times are 200 μ sec.

With a <POLL> and a <RECEIVE READY> 2 and 4 bytes are involved respectively, as indicated in table 3.1. The M+6 consists of a message length of M bytes plus 6 bytes overhead. The overhead is used for the station address, network control field, device control, station control, frame check and a flag to mark the end of a frame.

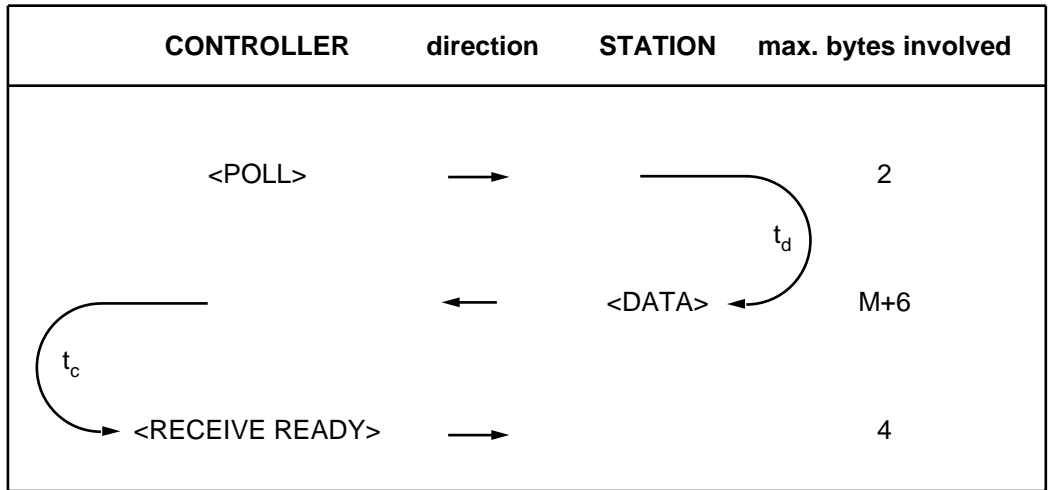


Table 3.1 Station - controller data exchange sequence.

controller - decoder data exchange(data flow 2 in fig. 3.1)

To send a message from the controller to a decoder station the data exchange as shown in table 3.2 is followed. Data is sent from the controller to the decoder station. After t_d seconds the station transmits a <RECEIVE READY> to acknowledge the data reception. Again the number of bytes involved are indicated in the right-hand column.

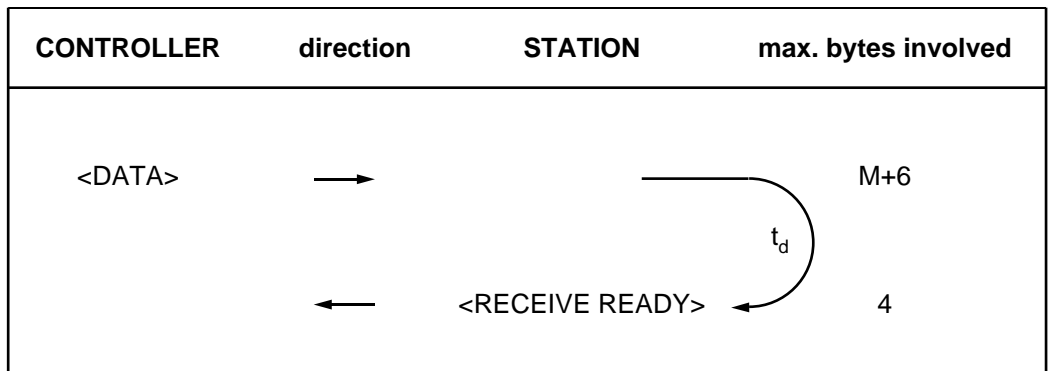
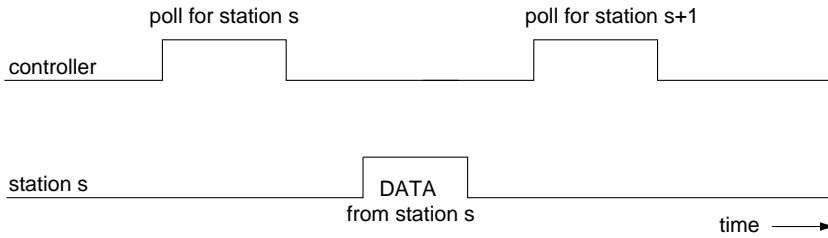
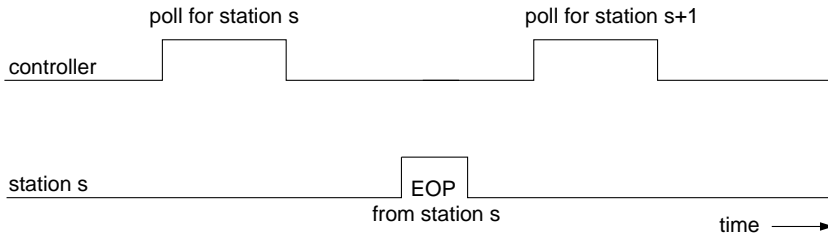


Table 3.2 Controller - station data exchange sequence.

- 1) **station s sends data after a poll**



- 2) **no data from station, station sends an EOP**



- 3) **the controller polls the next station after a poll time-out has occurred**

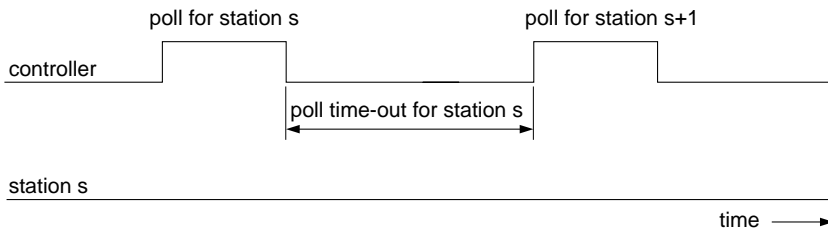


Figure 3.1 Possible reactions of a decoder on a poll.

polling stations

To poll the decoder station, the controller simply sends a message to each station in turn, inquiring whether or not the stations have data to send. These polling messages contain the address of the station inquired. Each decoder station knows its own address and only responds to its own polls, although it receives all polls. If the a decoder station has data to send it send data according to table 3.1. If not, it sends back an EOP-byte(=End of Poll). If neither data nor an <EOP>-byte is sent by the decoder, the controller will generate a poll for the next station after a poll time-out, as depicted in figure 3.2. In this way all decoder station are polled.

The time it takes to finish a complete sequence of polling a station, receiving an End of Poll and generating a poll for the next station is called the poll execution time. The poll cycle time is the time required to poll al stations on the network without exchanging data. In formula:

$$t_{pc} = Nt_{pe} = N(t_p + t_{eop} + t_{pg}) = N(3t_b + t_{pg}) = N \cdot 515 \mu s.$$

- In which:
- t_{pc} poll cycle time
 - t_{pe} poll execution time
 - t_p poll transmit time (2 bytes)
 - t_{eop} End of Poll transmit time (1 byte)
 - t_{pg} poll generation time, the delay between an <EOP> reception and the transmission of a new poll (250 μ s for OSENET).
 - t_{bo} transmit time for one byte
 - N number of stations

3.2 PROGRAMMING THE OSENET NETWORK

Once the network is installed in accordance with the guidelines in section 2.3, several features of the network can be programmed by bar code menu, or via the host computer as explained in section 4.X. If the controller is set with bar code menus, the bar codes in this section can be scanned with a bar code reader connected to port I1 of the controller. How to set the parameters is described extensively in section 4.1 of the "User's manual DD6000". A table with read direct labels is present in appendix B of this manual. This table is identical to the table in the decoder manual.

Appendix X+1 features labels which affect both the OSENET and/or the controller-host data link. Scanning these labels makes this section partly superfluous.

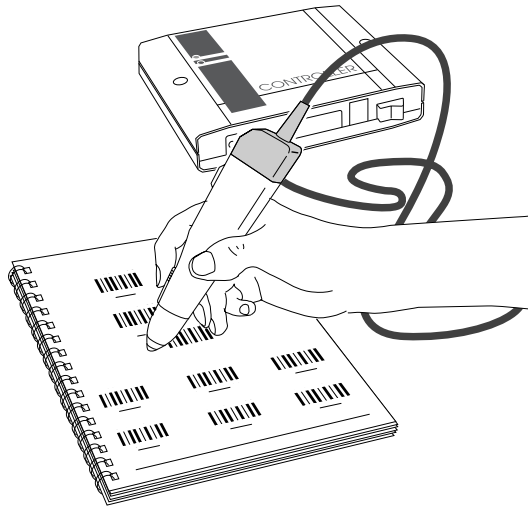


Figure 3.2 With a bar code reader connected to port I1 of the controller OSENET features can be programmed.

programmable features	page	selection with Read Direct Labels Appendix C
set the network baudrate	28-30	
set the number of stations	30-31	*
set station off-line	30-31	*
set station on-line	30-31	*
test RAM	30-31	
test EEPROM	30-31	
set the response time	32-33	
set the number of errors	34-35	
set the recovery time	36-37	

Table 3.3 Programmable features of OSENET.

For some features the table with read direct labels (Appendix B) should always be used, whereas for other features a selection can be made out of labels available on the page in question.

set the network baud rate - The baud rate (transmission speed) for OSENET is the number of bits transmitted per second. The baud rate can vary in steps between 75 and 125K kbps (=bits per second). Make sure that the baud rate of port O1 of all decoders on the network correspond to the baud rate set here. (please refer to the *"User's manual of the DD6000"* page 56-57 to set the decoder baud rate).

set the network baud rate:



//2



\$00



\$01



\$02



\$03



\$04



\$05



\$06



\$07



\$08



\$09



\$0A



\$0B



\$0C



\$0D



enter menu



exit menu



restore setup



save setup

set first station in the range - A decimal value should be read from the table with read direct labels in Appendix B. This label corresponds to the lowest number in the range of decoder stations.

set last station in the range - A decimal value should be read from the table with read direct labels in Appendix B. This label corresponds to the highest number in the range of decoder stations.

Please notice that all stations outside the specified range will be disabled.

disable station - Decoder stations not used can be disabled. After this label has been read, a decimal value (=the station that should be disabled) should be read from the table with read direct labels.

If a station is switched off but is not disabled, it delays the poll cycle with a poll time out for the station considered. An disabled station is not polled.

enable station - Disabled decoder stations can be enabled by reading this bar code label. After the label has been read, a decimal value (= the station that should be enabled) should be read from the table with read direct labels.

test RAM - Test the Static RAM of the network controller:

- high beep is OK!
- low beep is not OK!

test EEPROM - Test the EEPROM of the network controller:

- high beep is OK!
- low beep is not OK!

Please refer to the trouble shooting section if one of these parts of memory are not OK!

set first station in the range: **/H**
--->  --->

/A
set last station in the range: --->  --->

/F
disable station: --->  --->

/G
enable station: --->  --->

/D
test RAM: 

/E
test EEPROM: 




set the response time - The period of time in which a controller has to receive a reaction from a polled station. If no reaction is received a poll time-out will occur. Notice that for this time the network baud rate and cable length should be considered. After this label has been read, a label from the table with read direct labels should be read.


response time = decimal value of read direct label x 0.5 ms.

This time is different from the response time determined in section 5.

example:

The first read direct label is 

The response time is 0 x 0.5 ms. = 0 ms. This is the minimum response time.

The first read direct label is 

The response time is 255 x 0.5 ms. = 127.5 ms. This is the maximum response time.

set the number of errors - If the controller receives incorrect data from a station, or no reaction at all, the controller can switch off the decoder in question temporarily. With this option you can set the number of allowed errors which a controller can receive from a station before being switched-off. After this label has been read, a label from the table with read direct alabels should be read.

The decimal value of a label indicates the selected number of errors.
The maximum number of errors allowed is 51.

set the recovery time - The controller tries to switch stations which are off-line, on-line again after a period of time selected with this options.

recovery time = decimal value of read direct label x 0.1 ms.

set the response time:



set the number of errors:



set the recovery time:





4

controller-host communication protocol

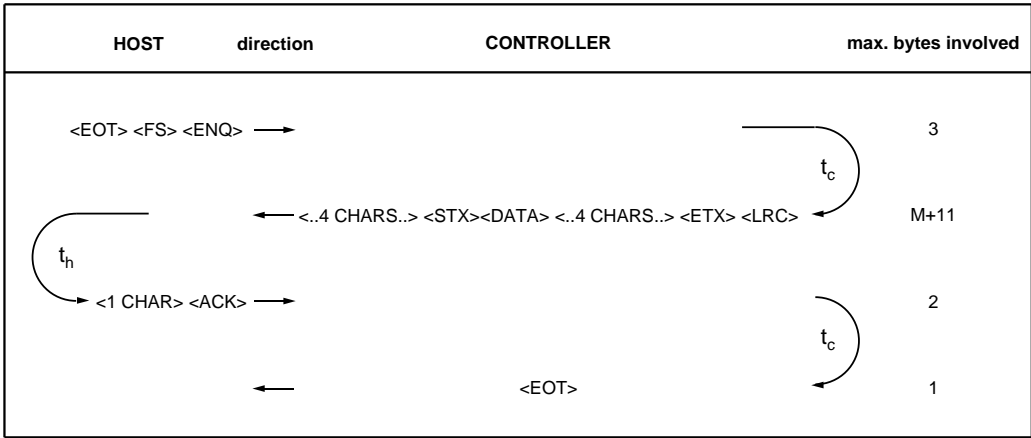


Table 4.1 Controller - host data exchange sequence.

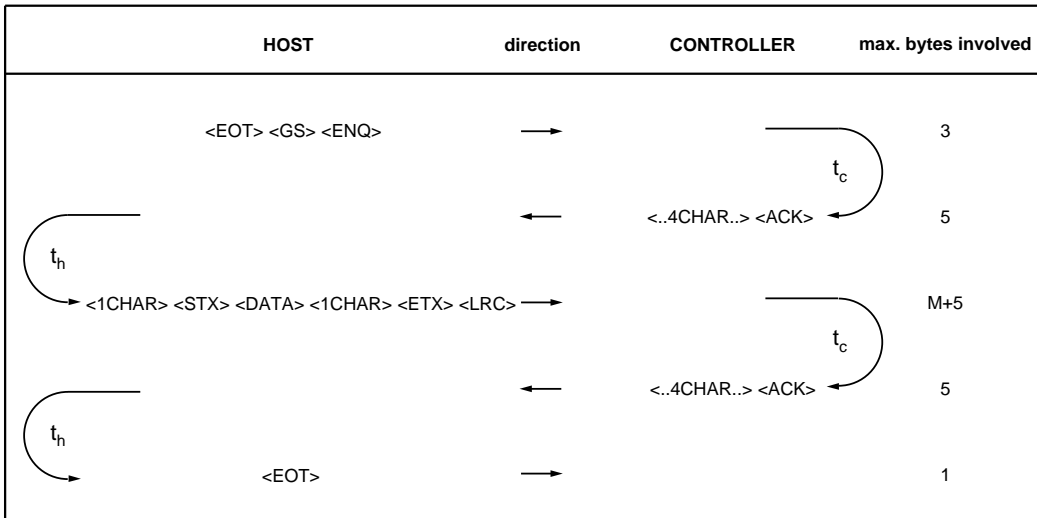


Table 4.2 Host - controller data exchange sequence.

host - controller communication

For host-controller communication either the RS232 or RS 422 can be used. If the distance between the controller and the host computer is long, the latter is preferred. Depending on the program running on the host computer, the communication protocol should be set. Three protocols are available:

- free running
- ANSI X3.28
- Intermec mode D

In case free running is selected, no protocol is active and data is transmitted in spite of control signals.

ANSI X3.28 is a user configurable protocol. It is based on the ANSI X3.28 standard, sub-category 2.4, A4. This protocol features: two way alternate non-switched multipoint operation, polling/selection mechanism, ACK/NAK handshaking and longitudinal redundancy check.



5

time analysis of OSENET

In this section formulas are derived which can be used to calculate the response time for the network designed. Roughly, the response time is defined as the time a DD6000-station has to wait to receive a response from the host after data has been read. The response time depends on many things such as network baud rate, host-controller baud rate, message length, number of stations, overhead, etc.

Once the network is installed and the host-controller protocol is configured, the formulas derived in this section can be used to calculate a response time for your network to check whether it is quick enough. If the calculated response time turns out to be too long, a few guidelines to reduce this time are indicated at the end of this section.

First the time to send a message for all data flows indicated in figure 3.1 will be calculated.

The default communication parameters for the OSENET network are:

Baud rate : 125000 baud
 Data format : 9 bit
 Stop bit : 1 bit
 Start bit : 1 bit

From these parameters, the time it takes to transmit a single data byte can be calculated, by dividing the bits in the byte by the baud rate:

$$t_{bo} = \frac{\text{start bit} + \text{stop bit} + \text{data bits}}{\text{baud rate}} = \frac{11}{125 \text{ K}} = 88 \mu\text{sec.} \quad (1)$$

In which t_{bo} is the time to transmit a single byte across the network.

decoder - controller data exchange(data flow 1 in fig. 3.1)

The time it takes to transmit a message of length M from the decoder to the controller, and to have this message acknowledged, can be derived from the data exchange sequence indicated table 3.1. This time is given as:

$$t_{sc} = t_{poll} + t_d + t_{data} + t_c + t_{rr} \quad (2)$$

- In which:
- t_{sc} time to transmit a message from a decoder to the controller
 - t_{poll} poll transmit time
 - t_d turnaround time for the decoder
 - t_{data} time to transmit data to the controller
 - t_c turnaround time for the controller
 - t_{rr} time to transmit an <rr> acknowledgement

With equation (1), the number of bytes for the data exchange and the turnaround times for the decoder and controller equation (2) leads to:

$$t_{sc} = 2t_{bo} + t_d + (M+6)t_{bo} + t_c + 4t_{bo} = 1.456 \text{ ms.} + 88M \mu\text{s.} \quad (3)$$

- In which:
- t_{sc} time to transmit a message from a decoder to the controller
 - t_{bo} time to transmit one byte
 - t_d turnaround time for the decoder
 - M message length
 - t_c turnaround time for the controller

controller - decoder data exchange(data flow 2 in fig. 3.1)

The time needed to send a frame to the station can be derived from the data exchange

$$t_{cs} = t_{data} + t_d + t_{rr} \quad (4)$$

sequence indicated in table 3.2. This time is given as:

- In which:
- t_{cs} time to transmit a message from the controller to a decoder
 - t_{data} time to transmit data to a decoder
 - t_d turnaround time for the decoder
 - t_{rr} time to transmit an <rr> acknowledgement

With equation (1), the number of bytes for the data exchange and the turnaround time for the decoders equation (4) leads to:

In which:

- t_{cs} time to transmit a message from the controller to a decoder
- t_{bo} time to transmit one byte
- t_d turnaround time for the decoder
- M message length

controller - host data exchange(data flow 3 in fig. 3.1)

Because the controller should be able to exchange data with any program running on a host computer, the protocols for this data link are highly configurable. In this section the worst case data exchanges for this data link are postulated.

For the host interface parameters the default settings are used:

Baud rate : 9600 baud
 Data format : 7 bit
 Start bit/Stop bit: 0 bit/2 bit
 Parity bit : even
 Interface : RS232 (no hardware handshaking)

$$t_{bh} = \frac{\text{stop bits} + \text{parity bit} + \text{data bits}}{\text{baud rate}} = \frac{10}{9600} = 1.04 \text{ ms.} \quad (6)$$

From these parameters, the time it takes to transmit a single data byte can be calculated, by dividing the bits in the byte by the baud rate:

In which t_{bh} is the time to transmit a single byte across the host-controller data link.

The data exchange sequence for sending a message with length M from the network controller to the host computer is depicted in table 4.1 in chapter 4. The indication <1 char> and <..4char..> refers to the additional characters which can be employed to configure the protocol required for the program running on the host computer.

$$t_{ch} = t_{h.enq} + 2t_c + t_{data} + t_h + t_{h.ack} + t_{c.eot} \quad (7)$$

The total time to transmit a message to the host and to react on the hosts acknowledgement with an <EOT> is given as:

- In which:
- t_{ch} time to transmit a message from the controller to the host
 - $t_{h.enq}$ time to transmit the <EOT><FS><ENQ> sequence
 - t_c turnaround time for the controller
 - t_{data} time to transmit data with additional control characters
 - t_h turnaround time for the host
 - $t_{h.ack}$ time to transmit an <ACK>
 - $t_{c.eot}$ time to transmit an <EOT>

With equation (6), the number of bytes for the data exchange and the turnaround times for the controller and host(assumed to be 200 μ s.), equation (7) leads to:

- In which:
- t_{ch} time to transmit a message from the controller to the host
 - t_{bh} time to transmit one byte
 - t_c turnaround time for the controller
 - t_h turnaround time for the host
 - M message length

host-controller data exchange(data flow 4 in fig. 3.1)

To send a message from the host computer to the network controller the data exchange

$$t_{hc} = t_{h.enq} + 2t_c + 2t_{c.ack} + t_{data} + 2t_h + t_{h.eot} \quad (9)$$

sequence as shown in table 4.2 is followed. The time needed to send a message of length M to the controller is:

- In which:
- t_{hc} time to transmit a message from the host to the controller
 - $t_{h.enq}$ time to transmit an enquiry to the controller
 - t_c turnaround time for the controller
 - $t_{c.ack}$ time to transmit an acknowledgement to the host
 - t_{data} time to transmit data to the controller
 - t_h turnaround time for the host
 - $t_{h.eot}$ time to transmit an <EOT>

$$t_{hc} = 3t_{bh} + 2t_c + (M+5)t_{bh} + 2t_h + 10t_{bh} + t_{bh} = 20.59 \text{ ms.} + 1.04M \text{ ms.} \quad (10)$$

With equation (6), the number of bytes for the data exchange and the turnaround times for the controller and host(assumed to be 200μs.), equation (9) leads to:

- In which:
- t_{hc} time to transmit a message from the host to the controller
 - t_{bh} time to transmit one byte
 - t_c turnaround time for the controller
 - t_h turnaround time for the host
 - M message length

With the equations (3), (5), (8) and (10) a worst case time response for one of N stations can be estimated. The worst case time is the time which elapses between sending and receiving data on a station. In this case all N stations are reading data, whereas the considered station is the last one to send its message. All messages are sent from the controller to the host, processed by the host and sent back to the controller. The

$$t_{resp} = 50t_{sc(M=10)} + 50t_{ch(M=10)} + 50t_{hc(M=10)} + 50t_{cs(M=10)} = 3.2 \text{ s.} \quad (11)$$

considered station is the last one to receive its data. Let the number of stations be 50 (N=50) and the message length be 10 characters (M=10) for all stations. Then: Apart from the fact that the change of occurrence is virtually impossible, the data transmissions across both data links are running almost parallel, the change that all stations have data to transmit at the same time is not very large.

example

The latter consideration is not very realistic. In this example a formula for a typical response time, still on the pessimistic side, will be derived. Assumed that:

- p% of all N decoders is transmitting data.
- the length of the data is 10 characters.(M=10).
- for the decoder-controller data link:125Kbps, 9 data bits, 1 start bit, 1 stop bit.
- the baud rate for the host-controller data link is 38K4 kbps.
- for the host-controller data link: 2 stop bits, 1 parity bit, 7 data bits.
- the prefix for all control character for the host-controller data link is one character.

- poll execution time $t_{pe} = 515\mu s$. (section 3.1)

With these assumptions $t_{sc} = 2.34ms$, $t_{cs} = 1.96ms$, $t_{ch} = 6.07ms$, $t_{hc} = 6.79ms$.

Not all stations want to transmit data. However, all stations are polled. Suppose that the first (100-p)% of the stations are polled and the first p% of the station have data to send. Once this data has arrived at the controller, it is sent to the host. From the host it is sent back to the controller, and back to the station in question. The data transmission on all data links happen sequential in time. In formula:

$$T_{res,typ} = (1-p)Nt_{pe} + Npt_{sc} + Npt_{ch} + Npt_{hc} + (1-p)Nt_{pe} + Npt_{cs}$$

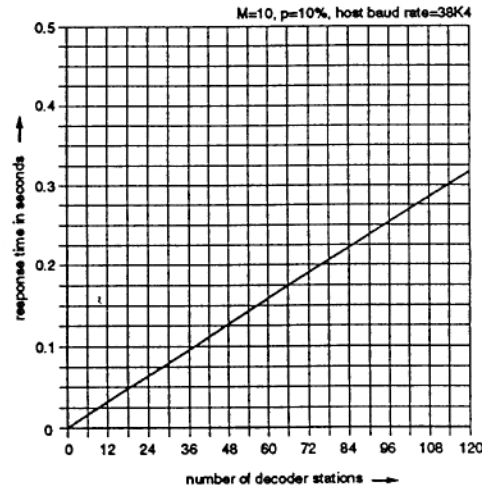
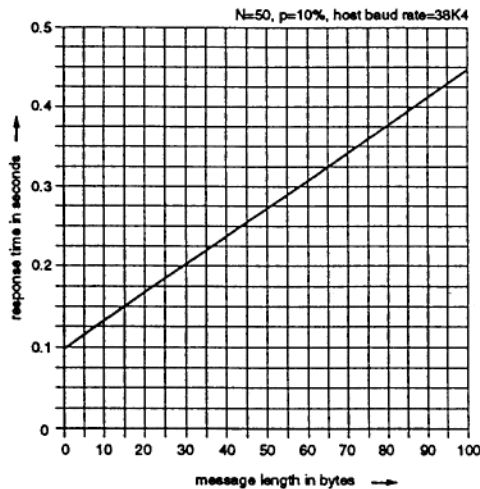
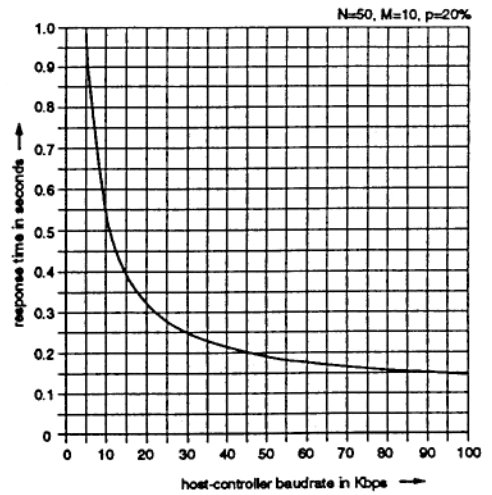
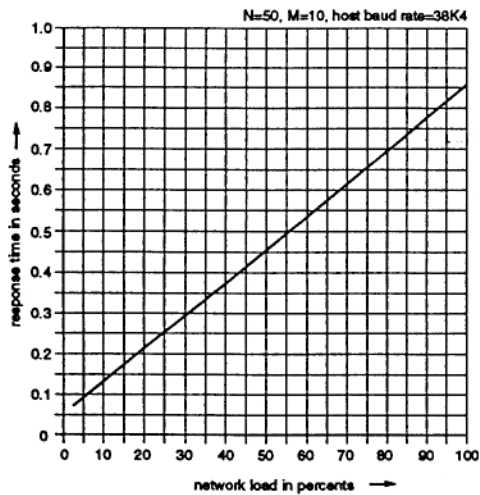
The diagrams on the next page give an impression of the speed of a network, based on the latter formula. In each figure only one parameter is a variable, whereas the other parameters are constants. These constant values are indicated in the upper left corner of each diagram.

In appendix C a listing of a BASIC-file is enclosed. This program calculates a more precise response time for your network. An extensive description of the program is given at the beginning of the appendix.

Reduction of response time

If the response time turns out to be too long the following guidelines should be followed:

- **Increase the host controller baud rate.** Although the default value for the baud rate is 9600 baud, most computers can handle a baud rate of 38K4 bps easily.
- **Reduce the overhead to a minimum.** The data frame for host-controller communication is highly programmable. Control characters can sometimes be preceded by 4 characters. Only use this feature if strictly necessary. To a lesser degree this also counts for the OSENET data link.
- **Stations switched off should be set off-line.** To prevent the controller from polling station which are switched off, the option on page 30-31 should be used to reduce the poll sequence of the network.



OSENET settings : default
 Host-controller settings : 1 parity bit/2 stop bits/7 data bits
 : each control character 1 prefix
 Poll sequence : N*515 μ s.
 Turnaround time host : 200 μ s.
 Turnaround time controller : 200 μ s.
 Turnaround time decoder : 200 μ s.

N = number of decoder stations
 M = message length
 p = network load

Figure 5.1 The response time of a network as a function of : the network load, the host baud rate, message length and the number of decoders



pin assignment of ports



This appendix contains the pin assignment of the data input port I1 and communication ports O1 and O2. Indication of signalling direction (in/out) is related to the DD6000 controller. See figure A-1 description of the connector used.

A.1 PIN ASSIGNMENT PORT O1

<i>pin</i>	<i>in/out</i>	<i>description</i>
1. Frame ground		connected to housing
2. TxD RS232	out	<u>T</u> ransmitted <u>D</u> ata: transmit data to host computer
3. RxD RS232	in	<u>R</u> eceived <u>D</u> ata: receive data from host computer
4. RTS RS232	out	<u>R</u> equest <u>T</u> o <u>S</u> end: desire (demand) to transmit data
5. CTS RS232	in	<u>C</u> lear <u>T</u> o <u>S</u> end: permission of host to transmit data
6. Not connected		
7. Logic ground		Signal Ground
8. Not connected		
9. T+ RS485	out	<u>T</u> ransmit differential voltage
10. T- RS485	out	<u>T</u> ransmit differential voltage
11. TR+ RS485	in/out	<u>T</u> ransmit/ <u>R</u> eceive differential voltage
12. TR- RS485	in/out	<u>T</u> ransmit/ <u>R</u> eceive differential voltage
13. Not connected		
14. Not connected		
15. Not connected		
16. Not connected		
17. Not connected		
18. Not connected		
19. Not connected		
20. Not connected		
21. Not connected		
22. Not connected		
23. Not connected		
24. Not connected		
25. +5V	in/out	Vcc

A.2 PIN ASSIGNMENT PORT O2

<i>pin</i>	<i>in/out</i>	<i>description</i>
1.		connected to housing
2-6.		
7.		Signal Ground
8.		
9.	in/out	<u>T</u> ransmit/ <u>R</u> eceive differential voltage
10.	in/out	<u>T</u> ransmit/ <u>R</u> eceive differential voltage
11.	out	<u>T</u> ransmit differential voltage
12.	out	<u>T</u> ransmit differential voltage
13-24.		Not connected
25.	in/out	Vcc

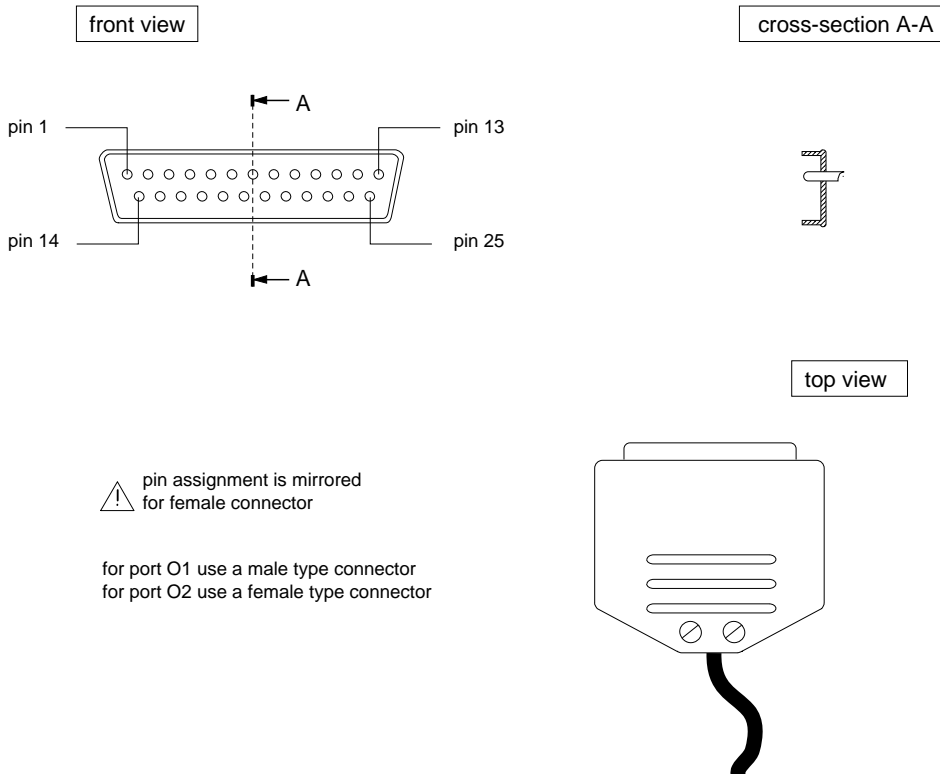


Figure A-1. Standard DB25 connector used for port O1 and port O2.

A.3 PIN ASSIGNMENT PORT I1

See figure A-2 description of the connector used.

<i>pin</i>	<i>in/out</i>	<i>description</i>
1. start of scan	in	signal from peripheral to indicate a scan has started
2. TTL in	in	data from peripheral
3. Good read	out	confirmation of a good read by the decoder
4. Motor failure sense	in	signal for a defective motor
5. Trigger switch	in	signal for triggering DD6000
6. LED enable	out	signal to enable scanner after trigger
7. Ground		
8. Ground		
9. +5 Volt		

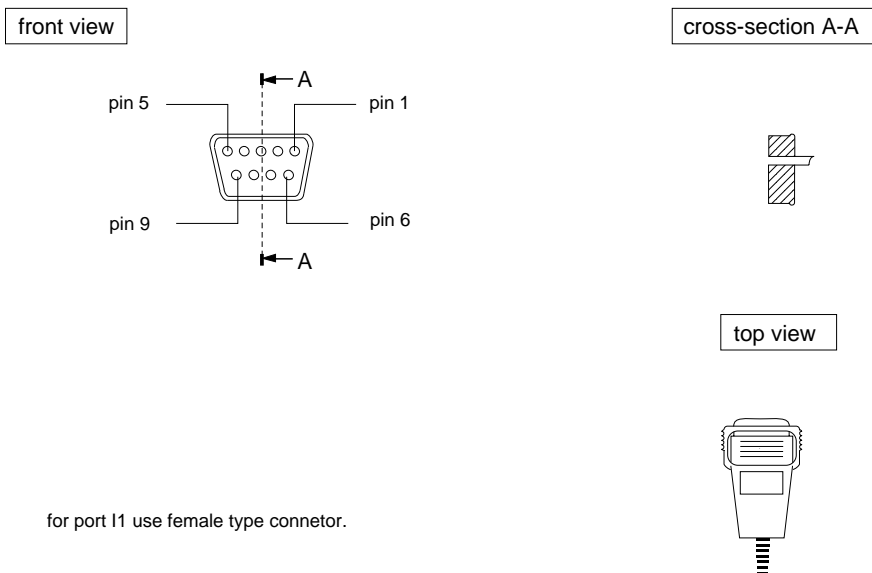


Figure A-2. Standard DB9 connector used for port I1.



table with read direct labels



The read direct labels can be used to:

1. enter numerical data from 0 to 255.(decimal indication)

example: if the label below is read after the "set station off-line" has been read, station 8 will be set off-line.

2. set alternative control-characters.(ASCII indication)

example: if a poll from the host should be preceded by an ASCII-character <BS>, the label below should be read.



- _____ 3. find the hexadecimal representative of the bar code labels

example: reading the code with hexadecimal value `*$08*` after the label "set network baud rate, sets the baud rate 9600 baud. If it is read after the "set response time "-label has been read, the maximum allowed response time will be 4.5 ms.



000 -NUL- \$00



008 -BS- \$08



016 -DLE- \$10



001 -SOH- \$01



009 -HT- \$09



017 -DC1- \$11



002 -STX- \$02



010 -LF- \$0A



018 -DC2- \$12



003 -ETX- \$03



011 -VT- \$0B



019 -DC3- \$13



004 -EOT- \$04



012 -FF- \$0C



020 -DC4- \$14



005 -ENQ- \$05



013 -CR- \$0D



021 -NAK- \$15



006 -ACK- \$06



014 -SO- \$0E



022 -SYN- \$16



007 -BEL- \$07



015 -SI- \$0F



023 -ETB- \$17











132 -ctrl make- \$84



141 -ctrl break- \$8D



150 -<F7>- \$96



133 -ctrl make- \$85



142 -num break- \$8E



151 -<F8>- \$97



134 -num make- \$86



143 -all break- \$8F



152 -<F9>- \$98



135 -all make- \$87



144 -<F1>- \$90



153 -<F10>- \$99



136 -shift break- \$88



145 -<F2>- \$91



154 -<F11>- \$9A



137 -shift break- \$89



146 -<F3>- \$92



155 -<F12>- \$9B



138 -all break- \$8A



147 -<F4>- \$93



156 -<F13>- \$9C



139 -all break- \$8B



148 -<F5>- \$94



157 -<F14>- \$9D



140 -ctrl break- \$8C



149 -<F6>- \$95



158 -<F15>- \$9E





186

\$BA



195

\$C3



204

\$CC



187

\$BB



196

\$C4



205

\$CD



188

\$BC



197

\$C5



206

\$CE



189

\$BD



198

\$C6



207

\$CF



190

\$BE



199

\$C7



208

\$D0



191

\$BF



200

\$C8



209

\$D1



192

\$C0



201

\$C9



210

\$D2



193

\$C1



202

\$CA



211

\$D3



194

\$C2



203

\$CB



212

\$D4



213

\$D5



222

\$DE



231

\$E7



214

\$D6



223

\$DF



232

\$E8



215

\$D7



224

\$E0



233

\$E9



216

\$D8



225

\$E1



234

\$EA



217

\$D9



226

\$E2



235

\$EB



218

\$DA



227

\$E3



236

\$EC



219

\$DB



228

\$E4



237

\$ED



220

\$DC



229

\$E5



238

\$EE



221

\$DD



230

\$E6



239

\$EF





listing response time program

The following program can be used to calculate the response time for your network. For several parameters of both data links a value should be entered. (Most values can be set with the bar code options in section 3 and 4). By pressing the <CR>-key the default value for a parameter is selected. An other value can be entered if the <ESC>-key is pressed. First a description of the parameter values to be entered is given.

***** OSEnet data link settings *****

number of decoder stations: The number of decoders connected to your network. Enter a value 1-126.

OSEnet baud rate : The transmission speed across the network. Default is 125Kbps.

average message length : The average length of data send from the decoder stations to the host. For instance, if most of the time UPCA codes are read, the message length is 12.

network load in % : If 50 decoders are on-line and on 5 decoders a total of 10 scanners are reading labels simultaneously, the network load is 20%.

***** host-controller data link settings *****

host baud rate : The baud rate for the host-controller data link. Default value is 9600 bps. A transmission speed of 38400 baud is recommended.

number of data bits : The number of data bits can be 7 or 8. Default is 7 data bits.

number of stop bits : The number of stop bits can be 1 or 2. Default is 2 stop bits.

please refer to table 4.2 for host-controller data exchange.
number of bytes for from host poll:

The number of bytes for a poll can be 1, 2 or 3.

number of bytes for first to host acknowledgement:

The number of bytes is can vary between 1 and 5.

number of bytes accompanying the data bytes:

The number of additional bytes is can vary
between 3 and 5.

number of bytes for second to host acknowledgement:

The number of bytes is can be 1 or 5.

BASIC PROGRAM LISTING

```
10 CLS
20 PRINT "***** OSEnet data link settings *****"
30 PRINT ""
40 INPUT "number of decoder stations: ", N
50 PRINT "-"
60 PRINT "OSEnet baud rate      : "
70 PRINT "<CR>=125000, <ESC>=value"
80 GOSUB 1230
90 IF A$ = CHR$(27) THEN 120
100 OB = 125000
110 GOTO 130
120 INPUT "your value: "; OB
130 PRINT "-"
140 A$ = ""
150 PRINT "average message length  : "
160 PRINT "<CR>=10, <ESC>=value"
170 GOSUB 1230
180 IF A$ = CHR$(27) THEN 210
190 M = 10
200 GOTO 220
```

```

210 INPUT "your value :"; M
220 PRINT "-"
230 A$ = ""
240 PRINT "network load in %      : "
250 PRINT "<CR>=10%, <ESC>=value"
260 GOSUB 1230
270 IF A$ = CHR$(27) THEN 300
280 p = 10
290 GOTO 310
300 INPUT "your value :"; p
310 tsc = (12 + M) * 11 / OB + .0004
320 tcs = (10 + M) * 11 / OB + .0002
330 PRINT ""
340 PRINT ""
350 PRINT "***** host-controller data link settings *****"
360 PRINT ""
370 A$ = ""
380 PRINT "host baud rate      : "
390 PRINT "<CR>=9600, <ESC>=value"
400 GOSUB 1230
410 IF A$ = CHR$(27) THEN 440
420 HB = 9600
430 GOTO 450
440 INPUT "your value: "; HB
450 PRINT "-"
460 A$ = ""
470 PRINT "number of data bits    : "
480 PRINT "<CR>=7, <ESC>=value"
490 GOSUB 1230
500 IF A$ = CHR$(27) THEN 530
510 D = 7
520 GOTO 540
530 INPUT "your value :"; D
540 PRINT "-"
550 A$ = ""
560 PRINT "number of stop bits    : "
570 PRINT "<CR>=1, <ESC>=2"
580 GOSUB 1230
590 IF A$ = CHR$(13) THEN 620
600 S = 2
610 GOTO 630

```

```

620 S = 1
630 PRINT "- "
640 A$ = ""
650 PRINT "parity y/n          : "
660 WHILE LEN(A$) = 0
670 A$ = INKEY$
680 IF (A$ = CHR$(89) OR A$ = CHR$(121)) THEN PA = 1
690 IF (A$ = CHR$(78) OR A$ = CHR$(110)) THEN PA = 0
700 IF A$ = CHR$(13) THEN A$ = ""
710 WEND
720 PRINT "- "
730 A$ = ""
740 PRINT "turnaround time for host : "
750 PRINT "<CR>=2e-4 s., <ESC>=value"
760 GOSUB 1230
770 IF A$ = CHR$(27) THEN 800
780 TH = .0002
790 GOTO 810
800 INPUT "your value :"; TH
810 PRINT "- "
820 A$ = ""
830 PRINT "please refer to appendix E"
840 PRINT "protocol (f)irst table, (s)econd table, set (n)ow"
850 PRINT "- "
851 REM TABLE 1 NO ADDITIONS, TABLE 2 INTERMEC
860 WHILE LEN(A$) = 0
870 A$ = INKEY$
880 WEND
890 IF (A$ = CHR$(70) OR A$ = CHR$(102)) THEN 920
900 IF (A$ = CHR$(83) OR A$ = CHR$(115)) THEN 950
910 IF (A$ = CHR$(78) OR A$ = CHR$(110)) THEN 980
920 Tch = (M + 8) * (PA + D + S) / HB + .0004 + TH
930 Thc = (M + 9) * (PA + D + S) / HB + .0004 + 2 * TH
940 GOTO 1190
950 Tch = (M + 4) * (PA + D + S) / HB + .0002 + TH
960 Thc = (M + 5) * (PA + D + S) / HB + .0004 + TH
970 GOTO 1190
980 PRINT "please refer to table 4.1 for controller-host data exchange"
990 PRINT " "
1000 INPUT "number of bytes for from host poll: "; CHP
1010 PRINT "- "

```

```

1020 INPUT "number of bytes accompanying the data bytes:"; CHD
1030 PRINT "-"
1040 INPUT "number of bytes for from host acknowledgement:"; CHA
1050 TEOT = 1
1060 PRINT " "
1070 PRINT "please refer to table 4.2 for host-controller data exchange"
1080 PRINT " "
1090 INPUT "number of bytes for from host poll:"; HCP
1100 PRINT "-"
1110 INPUT "number of bytes for first to host acknowledgement:"; HCA1
1120 PRINT "-"
1130 INPUT "number of bytes accompanying the data bytes:"; HCD
1140 PRINT "-"
1150 INPUT "number of bytes for second to host acknowledgement:"; HCA2
1160 FEOT = 1
1170 Tch = (M + CHP + CHD + CHA + TEOT) * (PA + D + S) / HB + .0004 + TH
1180 Thc = (M + HCP + HCA1 + HCD + HCA2 + FEOT) * (PA + D + S) / HB + .0004 +
    2 * TH
1190 Tpe = .000515
1200 Tresp = 2 * N * (1 - p / 100) * Tpe + N * p / 100 * (tsc + tcs) + N * p / 100 * (Tch +
    Thc)
1210 PRINT "the response time is:"; Tresp; ".s"
1220 GOTO 1280
1230 WHILE LEN(A$) = 0
1240 A$ = INKEY$
1250 IF A$ = CHR$(13) THEN RETURN
1260 IF A$ = CHR$(27) THEN RETURN
1270 WEND
1280 END

```


parity y/n : For even, odd, mark and space enter y(es). If no parity is set enter n(o).

turnaround time for host : Depends on the program running on your host computer, and is not easy to determine.

please refer to appendix E.

protocol (f)irst table, (s)econd table, set (n)ow:

Standard values for the control characters for the host-controller data link can be selected. Refer to appendix X if you want to use default settings. With the first table a minimum of control characters is selected for data control across the data link. With the second table Intermecc settings are selected. Once the first or second table are selected, the response time is calculated. If an (n) is entered, the number of bytes for the host and controller data exchange should be set first.

please refer to table 4.1 for controller-host data exchange.
number of bytes for from host poll:

The number of bytes for a poll can be 1, 2 or 3.

number of bytes accompanying the data bytes:

The number of additional bytes is can vary between 3 and 11.

number of bytes for from host acknowledgement:

The number of bytes is can be 1 or 2.

number of bytes for from host acknowledgement:

The number of bytes is can be 1 or 2.



D

glossary of terms

In this appendix only terms related to the DD6000 network are explained. Terms not present in this glossary probably are present in the glossary of the manual for the DD6000 decoder.

Acknowledgement (ACK) - A control character sent to notify that data has been correctly received.

Buffer - Part of memory in which data can be stored before being processed. A buffer is needed if a device can receive data more quickly than it can process that data.

Control characters - All ASCII-characters with a code <20h plus the character (ASCII code 7Fh). These characters have a data control function instead of representing an alphanumeric character.

Data Link Escape (DLE) - Control characters preceded by a <DLE>-character are considered to be normal data characters.

Differential Voltage - A method for signal transmission. The voltage difference between two lines determines whether a "0" or "1" is transmitted. The RS422/485 uses differential voltage for signal transmission. This way of signal transmission is less sensitive to noise.

End of Poll (EOP) - A character sent by a decoder station, as a reaction on a poll enquiry, to indicate that it has no data to send.

End of Text (EOT) - A control character that indicates the end of a data frame.

End of Transmission - Concludes a data transmission. This EOT character is used to signal the end of any previous communication. The <EOT> character should not have a prefix.

Enquiry (ENQ) - A control character to indicate a response message is requested.

Error message - An audible or visual indication of hardware or software malfunction or of an illegal data entry attempt.

Full duplex - A transmission channel that provides simultaneous transmission of data between two devices, in both directions.

Hexadecimal - A number system with a base of 16. The symbols used in this system are the decimal digits 0 through 9 and six additional digits which are represented as A, B, C, D, E and F corresponding to 10, 11, 12, 13, 14, 15. The hexadecimal representation of the decimal number 107 is 6Bh ($107 = 6 \cdot 16^1 + 11 \cdot 16^0$)

Longitudinal Redundancy Check (LRC) - The frame check character. The i^{th} of the <LRC>-character is the exclusive-OR of the i^{th} bit of all characters in the frame.

Multi-drop - A communication link which allows more than two devices to be directly attached. OSEnet allows up to 126 decoders to be attached to a single host computer via a controller.

Negative Acknowledgement (NAK) - A control character sent to notify that data has been incorrectly received or not received at all (after a time out period). Sending a <NAK> implies the retransmission of the incorrectly received data.

Network cable - or Main cable, is a Multi-drop cable that establishes the physical link between the controller's port O2 and the decoders' port O1.

Off-line station - Pertaining to a decoder part of the network but not polled. The presence of the decoder station does not affect the poll cycle time.

On-line station - Pertaining to a decoder part of the network and periodically being polled.

OSEnet-cable - The physical link between the controller/decoders of the network and their belonging connector boxes.

Overhead - The characters sent next to the actual data. These characters are needed to control the data exchange.

Poll - A periodic interrogation from the decoders by the controller. If a poll for a certain station is sent, only this station is allowed to react with data or an EOP-message.

Poll cycle time - The time to poll all stations connected to the network without exchanging data.

Poll execution time - The time to finish a complete sequence of polling a station, receiving an EOP-message and generating a poll for the next station.

Poll generation time - The time between reception of an EOP-message and transmission of a new poll by the controller.

Recovery time - The period of time after which stations, set off-line the controller after a number of errors, will be set on-line again.

Response time_1 - The time it takes your system to have a reaction at a decoder station after a label has been read here.

Response time_2 - The period of time in which a controller has to receive a reaction from a polled station.

RS232 - An industry standard for communication between computers and various types of peripheral equipment.

RS422/485 - An industry standard for communication in multipoint systems. RS422 is employed for point to point interconnections, whereas RS485 is employed in a multipoint environment.

Start of Text (STX) - A control character preceding a sequence of characters that is to be interpreted as an entity. (e.g. text or message).

