INTERNATIONAL STANDARD

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First edition
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Cable networks for television signals, sound signals and interactive services –

Part 7-3: Hybrid Fibre Coax Outside Plant Status Monitoring – Power supply to Transponder Interface Bus (PSTIB) Specification

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

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CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 7-3: Hybrid Fibre Coax Outside Plant Status Monitoring – Power Supply to Transponder Interface Bus (PSTIB) specification

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International Standard IEC 60728-7-3 has been prepared by technical area 5: Cable networks for television signals, sound signals and interactive services, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This standard was submitted to the national committees for voting under the Fast Track Procedure as the following documents:

CDV	Report on voting
100/578/CDV	100/685/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The following differences exist in some countries:

The Japanese *de facto* standard (NCTEA S-006) concerning requirements for the HFC outside plant management, which was published in 1995, has already been available in Japan. The purpose of this standard is to support the design and implementation of interoperable management systems for HFC cable networks used in Japan.

INTRODUCTION

Standards of the IEC 60728 series deal with cable networks for television signals, sound signals and interactive services including equipment, systems and installations for

- head-end reception, processing and distribution of television and sound signals and their associated data signals, and
- processing, interfacing and transmitting all kinds of signals for interactive services

using all applicable transmission media.

All kinds of networks like

- CATV-networks,
- MATV-networks and SMATV-networks,
- individual receiving networks

and all kinds of equipment, systems and installations installed in such networks, are within this scope.

The extent of this standardization work is from the antennas, special signal source inputs to the head-end or other interface points to the network up to the system outlet or the terminal input, where no system outlet exists.

The standardization of any user terminals (i.e. tuners, receivers, decoders, multimedia terminals, etc.) as well as of any coaxial and optical cables and accessories therefore is excluded.

CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 7-3: Hybrid Fibre Coax Outside Plant Status Monitoring – Power Supply to Transponder Interface Bus (PSTIB) specification

1 Scope

This part of IEC 60728 specifies requirements for the Hybrid Fibre Coax (HFC) Outside Plant (OSP) Power Supplies (PS). This standard is part of a series developed to support the design and implementation of interoperable management systems for evolving HFC cable networks. The purpose of the standards is to support the design and implementation of interoperable management systems for evolving HFC cable networks. The Power Supply to Transponder Interface Bus (PSTIB) specification describes the physical (PHY) interface and related messaging and protocols implemented at the Data Link Layer (DLL) layers 1 and 2 respectively in the 7-layer ISO-OSI reference model, that support communications between compliant transponders and the managed OSP power supplies and other related power equipment to which they interface.

This standard describes the PSTIB PHY and DLL layer requirements and protocols that must be implemented to support reliable communications between all *type 2* and *type 3* compliant OSP transponders on the HFC plant and managed OSP power supplies and related hardware. Any exceptions to compliance with this staneard will be specifically noted as necessary. Refer to Table 1 for a full definition of the type classifications.

Transponder type classifications referenced within the HMS series of standards are defined in Table 1.

Table 1 – Transponder type classifications

Type	Description	Application
Type 0	Refers to legacy transponder equipment which is incapable of supporting the specifications	• This transponder interfaces with legacy network equipment through proprietary means. • This transponder could be managed through the same management applications as the other types through proxies or other means at the head-end
Type 1	Refers to stand-alone transponder equipment (legacy or new), which can be upgraded to support the specifications	• This transponder interfaces with legacy network equipment through proprietary means. • Type 1 is a standards-compliant transponder (either manufactured to the standard or upgraded) that connects to legacy network equipment via a proprietary interface
Type 2	Refers to a stand-alone, compliant transponder	• This transponder interfaces with network equipment designed to support the electrical and physical specifications defined in the standards. • It can be factory or field-installed. • Its RF connection is independent of the monitored NE
Type 3	Refers to a stand-alone or embedded, compliant transponder	• This transponder interfaces with network equipment designed to support the electrical specifications defined in the standards. • It may or may not support the physical specifications defined in the standards. • It can be factory-installed. It may or may not be field-installed. • Its RF connection is through the monitored NE

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EIA RS-485, Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following definitions apply.

3.2
data link layer (DLL)
layer 2 in the Open System Interconnection (OSI) architecture; the layer that provides services to transfer data over the physical transmission link between open systems

3.3
network element (NE)
an active element in the outside plant (OSP) that is capable of receiving commands from a head-end element (HE) in the head-end and, as necessary, providing status information and alarms back to the HE

3.4
open system interconnection (OSI)
framework of International Organization for Standardization (ISO) standards for communication between multi-vendor systems that organizes the communication process into seven different categories that are placed in a layered sequence based on the relationship to the user. Each layer uses the layer immediately below it and provides services to the layer above. Layers 7 through 4 deal with end-to-end communication between the message source and destination, and layers 3 through 1 deal with network functions

3.5
physical (PHY) layer
layer 1 in the Open System Interconnection (OSI) architecture; the layer that provides services to transmit bits or groups of bits over a transmission link between open systems and which entails electrical, mechanical and handshaking procedures

3.6
transponder
device that interfaces to outside plant (OSP) NEs and relays status and alarm information to the HE. It can interface with an active NE via an arrangement of parallel analogue, parallel digital and serial ports

3.7 Abbreviations

DLL	Data Link Layer
EMS	Element Management System
Gnd	Grund
HE	Head-end Element
HFC	Hybrid Fibre Coax
ISO	International Organization for Standardization

ISO	International Organization for Standardization
LED	Light Emitting Diode
MAC	Media Access Control
NE	Network Element
OSI	Open System Interconnection
OSP	Outside Plant
PHY	Physical
PSTIB	Power Supply to Transponder Interface Bus
RF	Radio Frequency
Rx	Receive
SNMP	Simple Network Management Protocol
Tx	Transmit
Tx En	Transmit Enable
xpndr	Transponder

4 Reference architecture forward and return channel specifications

The reference architecture for the series of specifications is illustrated in Figure 1.

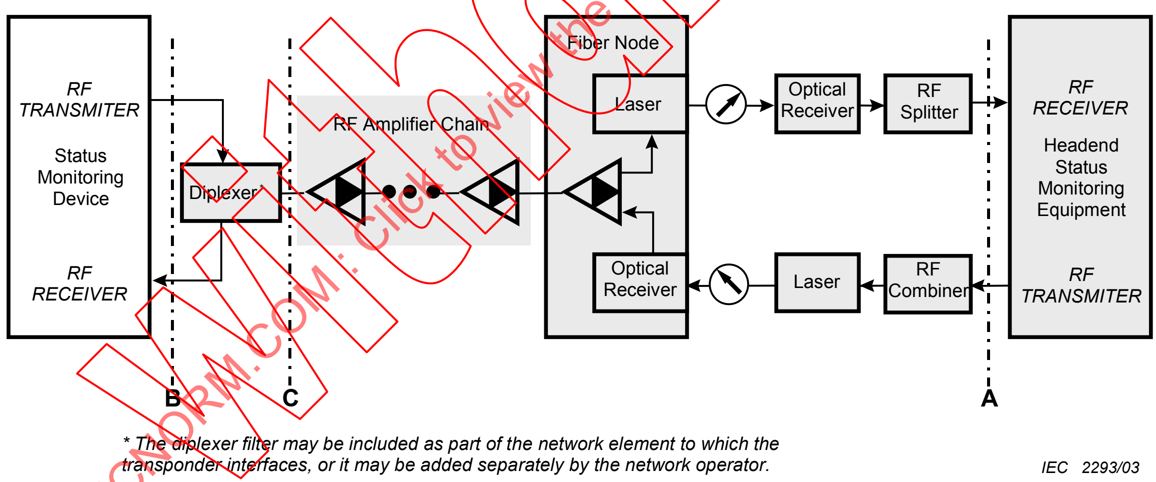


Figure 1 – Reference architecture diagram

All quantities relating to forward channel transmission or reverse channel reception are measured at point A in Figure 1. All quantities relating to forward channel reception or reverse channel transmission are measured at point B for two-port devices and point C for single-port devices as shown in Figure 1.

5 Power supply to transponder interface bus specification overview

PSTIB specification defines a status monitoring topology intended to replace existing analog, discrete status monitoring interfaces used today for monitoring power supplies and other power-related equipment deployed in HFC networks. In this topology, the transponder is simplified by moving all measurements and sensors to the monitored equipment, i.e. power supply or other power equipment. The transponder interfaces to the monitored equipment through a single multi-conductor cable. Transponder power is also provided through this interface. The power supply or other monitored power equipment assumes responsibility for measuring battery parameters, voltages, and other data associated with the equipment installation. Status and commands are passed between transponder and monitored equipment via a serial data interface bus.

The data protocol and command set are simple enough to be implemented in a simple micro-controller. The communication protocol is open and expandable so that as new requirements are defined they can be easily added to new revisions of this specification.

5.1 Interface compliance

Transponder and power supply vendors meeting the mechanical and electrical interface requirements at the PHY layer and the packet and protocol message formats at the DLL layer that are defined within this specification are said to be interface compliant. A Get_Configuration command (see 7.4.3) enables the transponder to determine compliance with a particular revision of this standard for power supplies or other power equipment. Support for this capability is critical as the PSTIB specification is updated over time and power supply equipment supporting different revisions of this specification co-exists within the same network.

5.2 Implementation compliance

Not all vendors will support the complete data set defined throughout this standard. The Get_Configuration response (see 7.4.3) provides the transponder or EMS with the specific status data that is and is not supported for each installation.

5.3 Revision control

The command and response data in this standard are synchronized that are used to represent this data in management systems. To maintain synchronization, a revision control mechanism must exist. Therefore, any time this standard is revised so that new data items are added to any command or response, those data items shall be appended to the END of an existing command or response definition. New command and response sequences may also be created as needed. No revision shall change the location, definition or function of a previously defined datum.

6 Power supply to transponder interface bus – Physical layer specification

6.1 Interface requirements

6.1.1 Connector type

The physical connector to support serial communications over the PSTIB between compliant transponders and managed OSP power supply hardware shall implement the following:

a) RJ-45, eight-wire conductor;

b) appropriate metallic plating for outdoor usage;

c) operating temperature: –40 °C to +70 °C;

d) dual connectors wired in parallel shall be included on the monitored equipment to support daisy-chaining multiple monitored devices from a single compliant transponder.

6.1.2 Communications interface

The communications interface shall support the EIA RS-485, Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems.

6.1.3 Connector signals

Connector pins shall support signalling as described in Table 2.

Table 2 – RJ-45 Connector pin assignment

Connector pin number	Signal
1, 8	Ground
2, 7	+24 V_{DC} ± 3,6 V_{DC} at 200 mA (relative tolerance of ±15 %)
3, 6	RS-485 (+)
4, 5	RS-485 (–)

6.1.4 Transponder power

Powering of transponders from PSTIB interface compliant power supplies shall support the following attributes:

a) the transponder is powered only from the power supply. The transponder shall not connect directly to the system batteries;

b) the power supply shall implement appropriate isolation and system grounding so that the communication interface and transponder power remains functional under the operating conditions defined herein;

c) the transponder shall be bonded to chassis ground directly and/or through the system coaxial cable sheath;

d) optionally, transponder power may be bonded to chassis ground at the power supply interface. The power supply vendor shall determine this;

e) the power supply shall implement appropriate over-current and short-circuit protection of transponder power so that the communication interface and transponder power remain functional under the operating conditions defined herein;

f) up to eight (8) power supplies may be connected in parallel using the RS-485 interface.

6.1.5 Line balance

6.1.5.1 Monitored equipment

Line balance for monitored equipment shall be implemented as follows:

a) RS-485 (+) to a DC voltage of +5 V through a resistor (jumper/switch removable);

b) RS-485 (–) to ground through a resistor (jumper/switch removable);

c) RS-485 (+) tied to RS-485 (–) through a resistor (jumper/switch removable);

d) monitored equipment shall include jumpers to select or bypass resistors to an open state. Jumper or switch-selectable terminating resistors enable on-site configuration of individual installations. Transponders shall include line balance resistors only. Refer to Figure 2.

6.1.5.2 Transponder

Line balance for transponders shall be implemented as follows:

– RS-485 (+) tied to RS-485 (–) through a required resistor.

NOTE Values for each resistor and the decision to include or exclude specific bias resistors as a default should be determined by individual vendors.

6.1.6 Cable length

A maximum cable length of 1 219,2 m (4 000 ft) (@100 kbit/s) properly terminated wire segment.

6.1.7 Data encoding

Non-return to zero (NRZ), asynchronous, 1 start bit, 8 data bits (ordering: bit 1,2 … 8), 1 stop bit. All integers are transmitted most significant byte first. Any exceptions to this rule will be specifically noted in this standard as necessary.

6.1.8 Bit rate

The bit rate supported shall be 9 600 Bd.

6.1.9 Duplex

This interface shall support half duplex operation. Multi-drop characteristics of RS-485 enable up to 32 drops per segment without signal repeaters.

6.1.10 Method of communications

All communication is transponder-initiated. One monitored device response per query.

6.1.11 Indicators

An LED or other visual device installed at the monitored equipment shall indicate communication has been established with a transponder over the PSTIB interface.

6.2 Interface diagram

The diagram in Figure 2 illustrates a sample RS-485 interface implementation to support PSTIB communications. This diagram should *not* be interpreted as a design requirement. It is only included to help clarify line bias and termination resistor placement. Table 3 describes the various signals that have been referenced in this diagram.

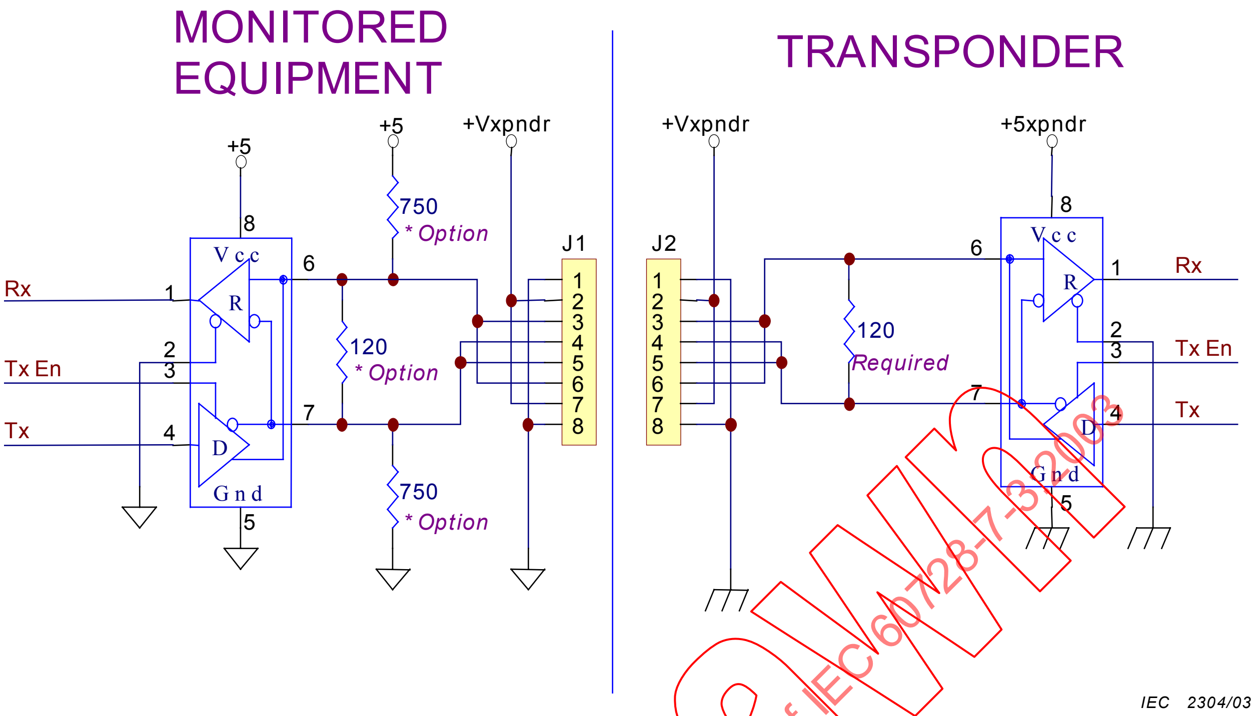


Figure 2 – Sample PSTIB RS-485 interface

Table 3 – Sample PSTIB RS-485 interface – Reference signals

Signal notation (Figure 2)	Description
+5	Monitored equipment voltage
+Vxpndr	Voltage supplied from the monitored equipment to the transponder as defined per this specification
+5xpndr	Transponder operating voltage derived at the transponder from +Vxpndr
**Option*	Indicates resistors that can be included or removed from circuit via user configurable jumper or switch
Required	Indicates resistor is required per this specification
J1, J2	The RJ-45 connectors used to interface transponders to monitored equipment. Pin numbers show currently defined interface signals per this specification
Rx, Tx, Tx En	Transmit, Receive and Transmit Enable. Illustrates possible connections to an RS-485 interface IC.
GROUND	The transponder should be chassis grounded. The monitored equipment may be tied to chassis ground directly, i.e. at the monitored equipment status interface, or through the interface ground (J1 pins 1,8). This should be at the discretion of the monitored equipment vendor. The monitored equipment and status interface should function correctly with whatever grounding method is selected.

7 Power supply to transponder interface bus – Data link layer specification

7.1 DLL packet structure

DLL packets consist of the following: start field, destination address field, source address field, identification field, a variable-length datagram field, end field and two-byte checksum field. DLL packet structure is illustrated in Figure 3.

Start **End**

Start	Destination Address	Source Address	Identification	Datagram	End	Checksum

Figure 3 – DLL packet structure

All DLL packets shall have the general format as described in Table 4.

Table 4 – Generic DLL packet structure

Field name	Length (bits)	Subclause
Start	16	7.1.1
Destination Address	8	7.1.2
Source Address	8	7.1.3
Identification	8	7.1.4
Datagram	32 to N	7.1.5
End	16	7.1.6
Checksum	16	7.1.7

7.1.1 Start

The Start field consists of two octets (bytes). This is the start sequence of all communication packets. This field shall consist of DLE (0x10) followed by STX (0x02).

7.1.2 Destination Address

The Destination Address field consists of a single octet and it uniquely identifies the device receiving the packet. Its value is between 0x00 and 0xFF (0-255 decimal). Table 5 includes the ranges of addresses that are currently defined as part of this standard.

Table 5 – Reserved destination address ranges

Range (decimal)	Range (hexadecimal)	Reserved for
0	0x00	Transponders
1 - 8	0x01 - 0x08	Power supplies
9 - 31	0x09 - 0x1F	Reserved for vendor specific equipment *
32 - 255	0x20 - 0xFF	Specified use
* NOTE It is recommended that 0x10 is not used as a device address to avoid additional DLE sequences (defined later in 7.2).		

7.1.3 Source Address

The Source Address field consists of a single octet and it uniquely identifies the device sending the packet. Its format is the same as that of the Destination Address field.

7.1.4 Identification

The Identification field consists of a single octet. It is used to help identify the packet and match send-receive packet sequences. The contents of this field are defined by the device initiating communications,i.e. as currently defined, this will always be the transponder. The receiving device will repeat the Identification in the corresponding field of its response packet.

7.1.5 Datagram

The Datagram field consists of a minimum of four octets. It contains the commands, command responses and data delivered to/from the higher layer protocols. Various datagram types and their structure are defined later in 7.4.

7.1.6 End

The End field consists of two octets. This is the end sequence of all communication packets. This field shall consist of DLE (0x10) followed by ETX (0x03).

7.1.7 Checksum

The Checksum field consists of two octets. This is the 16-bit (modulo 0x10000) sum of all bytes in the packet *excluding* the Start, End, and Checksum fields and any stuffed DLEs.

7.2 DLE sequence

Data Link Escape (DLE) sequence stuffing assures that both START (DLE, STX) and END (DLE, ETX) sequences will never be duplicated within the body of a packet. This technique is used to facilitate identifying the start and end of variable-length packets. Within the packet, if an octet is encountered having the value DLE, i.e. hexadecimal 0x10 or decimal 16, a second DLE is inserted into the data stream when the packet is transmitted. The following example illustrates this technique (data represented in hexadecimal format):

Original packet:	10	02	30	20	63	10	03	00	10	03	00	C6	
DLE stuffed:	10	02	30	20	63	10	10	03	00	10	03	00	C6

NOTE The above example illustrates only the DLE stuffing technique. Specific Command and Response information is not intended to represent actual data.

Notice the 6th and 7th octets in the original packet in the above example. These could mistakenly be interpreted as the end-of-packet sequence. The DLE-stuffed packet includes an additional DLE inserted in the sequence. The receiving device will detect the DLE combination, discard the inserted DLE and ignore the DLE ETX code embedded within the packet.

The following rules shall apply to DLE stuffing:

a) DLE stuffing is applied to the entire packet including the checksum. Therefore, an additional DLE character will be added for each checksum byte sent as 0x10 (DLE);

b) the start packet sequence (DLE, STX) and end packet sequence (DLE, ETX) are *not* DLE stuffed;

c) the value in any DLL datagram “Size of Data” field (see 7.4.1.2) does *not* include any stuffed DLE characters;

d) stuffed DLE characters are *not* included in packet checksum calculations.

7.3 Interface timing

7.3.1 Message synchronization and interaction

Transponders and monitored equipment must conform to the following:

a) transponders initiate all communications. Monitored equipment, for example power supplies, shall only respond to packets addressed to them;

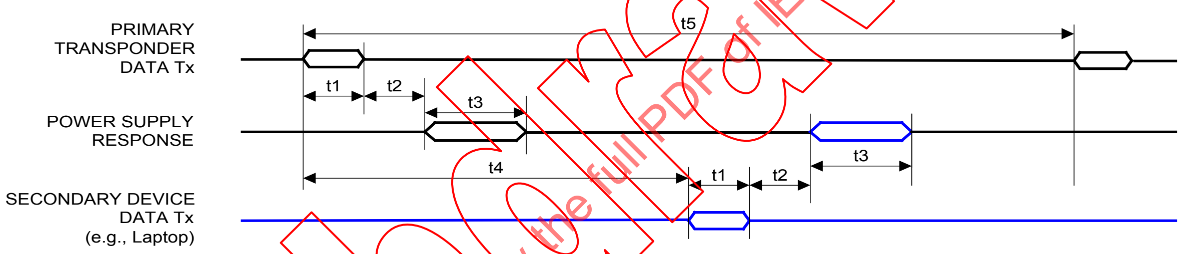
b) transponders powered directly via the RJ-45 physical connector from a PSTIB interface compliant power supply shall wait at least 15 s after power up and initialization before attempting to discover what power supplies they are connected to over the same PSTIB interface. A power supply shall be fully initialized and capable of responding to any data message as defined in this standard within 15 s after it has enabled power over the PSTIB interface to the transponder. The power supply shall not respond, nor respond with incorrect data, if it is interrogated before this time elapses;

c) transponders shall assign each data message a unique identification (refer to 7.1.4). The responding device shall repeat this identifier in the identification field of the response packet. The transponder shall verify the message identifier ensuring command/response synchronization;

d) transponders should include a mechanism to re-request or retry communications when either a corrupt response or no response is received from the monitored equipment. Since communication errors will occur in any system, transponders shall retry communications a minimum of three (3) times before reporting loss of communications with the monitored equipment to the EMS. If loss of communications occurs, the transponder shall attempt to re-establish communications with the monitored equipment at regular intervals. All communications shall conform to the timing requirements defined in this standard. See 7.3.2.

7.3.2 Transmission timing requirements

Figure 4 illustrates the data and timing diagram for transmissions over the PSTIB. Table 6 describes all relevant timing parameters and allowed minimum and maximum values.



IEC 2305/03

Figure 4 – PSTIB data and timing diagram

Table 6 – PSTIB timing specifications

Identifier	Characteristic	Minimum value	Maximum value
t1	PRIMARY or SECONDARY device packet duration	-	30 ms
t2	Delay – PRIMARY or SECONDARY device message complete to power supply start response	1 ms	30 ms
t3	Power supply packet duration (chatter detection)	-	300 ms
t4	PRIMARY device packet start to SECONDARY device packet start	390 ms	510 ms
t5	PRIMARY device poll cycle period	900 ms	3 s

The diagram in Figure 4 and Table 6 make provision for more than one device initiating communications over the PSTIB. If a device initiating communications is a transponder, i.e. a device with address 0x00, it is referred to as a PRIMARY device. If the device initiating communications is one with a non-zero address, i.e. a laptop PC or another transponder with non-zero address, it is referred to as a SECONDARY device.

7.3.2.1 Requirements for PRIMARY and SECONDARY devices

It may be desirable for on-site technicians to access power supply and generator system status using a laptop PC. This subclause defines the timing requirements for a laptop-based PC application program to send and receive status to and from the monitored equipment via the RS-485 interface without disrupting communications to or from the transponder. The following rules govern this mode of operation:

a) transponders and monitored equipment shall anticipate that there may be a SECONDARY device, for example a laptop PC, connected to the RS-485 bus;

b) the PRIMARY device, also called the transponder, shall be set to address zero. The SECONDARY device shall be set to any unused address;

c) in order to establish timing synchronization with the SECONDARY device, the transponder (with address 0x00) shall regularly transmit packets at a period herein defined by the timing requirements for the PRIMARY transponder;

d) the SECONDARY device shall determine if there is a zero-addressed PRIMARY device on the bus. It will do this by listening on the bus for a zero-addressed transponder;

e) if the SECONDARY device listens on the bus for a time equal to the maximum value of a PRIMARY device poll cycle period, i.e. 3 s, and does not hear a zero-addressed transponder, it shall proceed to operate as if it is the PRIMARY transponder;

f) if a SECONDARY device is acting as PRIMARY, and if 60 s or more have passed since the SECONDARY device has listened for a zero-addressed transponder, the SECONDARY device shall not transmit until it has again determined if there is a zero-addressed transponder on the bus;

g) a PRIMARY transponder shall be able to tolerate continuous bus collisions for up to 60 s without crashing and without deviating from any other requirements assigned to a PRIMARY transponder, i.e. it needs to continue transmitting at the defined period even though it may not be receiving any responses;

h) if a SECONDARY device; i.e. a device with non-zero address, is acting as PRIMARY and determines that a zero-addressed transponder has been placed on the bus, the non-zero addressed device shall cease acting like a PRIMARY transponder and immediately start acting like a SECONDARY device;

i) when a PRIMARY transponder is on the bus, a SECONDARY device shall start any transmission no less than “t4 minimum” after it has seen the PRIMARY transponder start a transmission;

j) when a PRIMARY transponder is on the bus, a SECONDARY device shall start its transmission no more than “t4 maximum” after it has seen the PRIMARY transponder start a transmission;

k) transponders which are permanently installed in a system shall be configured with address 0x00 and operate as a PRIMARY transponder;

l) for all responses, PRIMARY and SECONDARY devices shall confirm that the destination address is their own address, and process only those packets addressed to them; i.e. devices must *not* assume that all traffic on the bus is either from or to them;

m) monitored equipment shall be able to service requests from multiple devices. The monitored equipment can be assured by these rules that messages will never be interleaved; i.e. while responding to one device, they will never receive a request from a second device.

7.4 DLL datagrams

7.4.1 Structure

The Datagram field is defined as part of the DLL packet structure (see Figure 3). Datagrams contain commands, command responses and associated data. DLL datagram structure is illustrated in Figure 5.

COMMAND/ RESPONSE	Size of data	Variable binding

IEC 2306/03

Figure 5 – DLL datagram structure

All DLL datagrams must have the general format as described in Table 7.

Table 7 – Generic DLL datagram structure

Field name	Length (bits)	Subclause
COMMAND/RESPONSE	16	7.4.1.1
Size of data	16	7.4.1.2
Variable binding	0 to N	7.4.1.3

7.4.1.1 Command/Response

The Command/Response field consists of two octets (bytes). This field defines what action is to be performed. The Command/Response field is always present. Valid commands and responses are defined later in 7.4.3. This two-octet field is transmitted most significant byte first.

7.4.1.2 Size of Data

The Size of Data field consists of two octets. This value defines the size (in bytes) of the Variable Binding field. This Size of Data field is always present. If no data is associated with the command, the size will be 0x0000. This two-octet field is transmitted most significant byte first.

7.4.1.3 Variable Binding

This variable field contains data. The data length and content are specific to a particular command/response. This field is not always present. If no data are present, the Size of Data field is set to 0x0000.

7.4.2 Resolution versus accuracy

The Variable Binding field in a DLL datagram contains digital representations of analogue values. The resolution of each analogue value is listed in the tables describing associated variable bindings for each DLL datagram type in 7.4.3. Resolution does not imply accuracy. Vendors should disclose accuracy of status data for equipment in compliance with this specification. Any scaled analogue representation from a Get_Power_Supply_Data response (see 7.4.3.4) that reaches the minimum or maximum range defined for that value, i.e. 0 or 255, shall report the maximum (or minimum) value and *not* wrap around.

7.4.3 DLL datagram types

Valid datagram types defined in this standard are listed in Table 8.

Table 8 – DLL datagrams

Datagram name	Encoding	Size of data (bytes)	Subclause
Get_Configuration (Command)	0x3030	0	7.4.3.1
Get_Configuration (Response)	0x3130	Device type dependent	7.4.3.2
Get_Power_Supply_Data (Command)	0x3031	0	7.4.3.3
Get_Power_Supply_Data (Response)	0x3131	33	7.4.3.4
Power_Supply_Control (Command)	0x3232	1	7.4.3.5
Get_Generator_Data (Command)	0x3033	0	7.4.3.6
Get_Generator_Data (Response)	0x3133	10	7.4.3.7
Generator_Control (Command)	0x3234	1	7.4.3.8
Invalid_Request (Response)	0x34nn [1]	1	7.4.3.9
Request_Processed (Response)	0x35nn [2]	0	7.4.3.10

[1] nn is the second byte of the command that was not recognized.

[2] nn is the second byte of the command being processed.

7.4.3.1 Command: Get_Configuration

Table 9 provides a description for this datagram.

Table 9 – Command: Get_Configuration datagram

Description	Encoding	Size of data (bytes)	Variable binding
This command from the transponder to the monitored equipment requests the configuration status of the monitored device	0x3030	0	[NULL]

7.4.3.2 Response: Get_Configuration

Table 10 provides a description for this datagram.

Table 10 – Response: Get_Configuration datagram

Description	Encoding	Size of data (bytes)	Variable binding
Response from the monitored device to the transponder to a “Get_Configuration” command	0x3130	Device type dependent [1]	Contains table of configuration data [2] See Table 11, Table 12 and Table 13

[1] Fields in a Get_Configuration response are not allowed to assume the value “255” which is reserved as an extension flag for the unlikely event that any of the fields need to be represented as values >255. This condition can be addressed in later revisions as required but the value 255 is reserved at this time to assure later backward compatibility.

[2] Fields containing ASCII text data are NULL terminated, i.e. any unused locations AFTER the test message MUST be filled with NULL characters (0x00). NULL characters are used to indicate the end of a text message and MUST NOT be represented with any printed character(s) on the EMS display terminal.

Table 11 – Response: Get_Configuration datagram[1] variable binding (general)

Field #	Field name	Range	Description
1	Protocol version	1-254	Version of the SCTE HMS protocol implemented in the monitored equipment. The “protocol version” implementation will comply with the defined protocol in the HMS PSTIB document with the corresponding revision number. Example: a power supply implementing all commands and responses defined in HMS PSTIB Rev 4 would return a value of “0x04” in this field
2	Device type	1-254	A code identifying the general class of equipment being monitored. The intent of this field is to provide a one-to-one correspondence between a monitored device and an MIB file used by the EMS. Devices are defined as: – power supply – corresponds to SCTE HMS PS MIB document – generator – corresponds to SCTE HMS GEN MIB document – fibre node – corresponds to SCTE HMS FIBERNODE MIB document
3	Software version	8 octets	The content of this field is vendor-specific. The intent is to provide a text representation of the power supply or generator system software version. Any printable ASCII characters can be included in this field. NULL (0x00) characters are non-printable and are used to fill any unused locations in the 8-octet field following the text data
4	ID	32 octets	The content of this field is vendor-specific. The intent is to provide manufacturer and/or product specific ASCII text information that will propagate to the management console verbatim. The following special characters are defined in association with this field: “\” - used to cause a new line on the console display. Example: “ALPHA\XM2 9015” would appear at the monitoring station as: ALPHA XM2 9015

[1] Field entries 1 through 4 defined in this table are common to all monitored devices. The balance of field entries for the Response: Get_Configuration datagram are “device type” specific, i.e. power supplies respond differently from field power generators. See 7.4.3.2.1 and 7.4.3.2.2 for additional details.

7.4.3.2.1 Power supplies

Table 12 defines the balance of field entries expected from power supplies in the variable binding for the Response: Get_Configuration datagram.

Table 12 – Response: Get_Configuration datagram[1,2] variable binding (power supply)

Field #	Field name	Range	Description
5	Batteries	0-8	Number of batteries per string. Example: a 36V system will return "3" (0x03) in this field. A system may return "0" (0x00) to represent no batteries connected. This field enables the transponder and/or EMS to determine what quantity of "V(batt)" battery voltage measurements should be used (listed in the Get_Power_Supply_Data response) NOTE The number of batteries reported shall not exceed 8 for a single string and 4 for a dual string. Systems reporting more than 4 batteries are limited to 1 battery string. NOTE The transponder and/or EMS will interpret a "0" (0x00) returned from either Get_Configuration – "Batteries" or "Battery Strings" as no batteries connected.
6	Battery strings	0-2	Number of battery strings. This field enables the transponder and/or EMS to determine the number of battery strings connected to a power supply and how "V(batt)" data is handled from a Get_Power_Supply_Data request. Example: a battery strings value of "0" indicates that all V(batt) data should be ignored (no batteries are connected). A battery strings value of "1" indicates that there is a single system battery string of up to 8 batteries (quantity defined by Get_Configuration – Batteries). A battery strings value of "2" indicates two system battery strings of up to 4 batteries each NOTE The transponder and/or EMS will interpret a "0" (0x00) returned from either Get_Configuration – "battery strings" or "batteries" as no batteries connected.
7	Temperature sensors	0-2	Number of battery temperature sensors NOTE The location of each temperature sensor is application-specific.
8	Outputs	1-5	Number of power supply outputs. This field enables the transponder and/or EMS to determine how many of the "I(out) 1-5" values represented in fields 2, 3, 4, 5 and 6 of the Get_Power_Supply_Data response datagram should be used. If only one output is active, I(out) 1 will be used
9	Battery current	1-4	Defines if battery current is measured in this installation. Values are enumerated as follows: **1** = no battery current measurements. Discard associated values in fields 16, 17, 18 and 19 of the Get_Power_Supply_Data response datagram. **2** = battery string "A" current only is measured. This setting also applies to a single current sensor set-up to measure the sum of both battery strings "A+B". Indicates that the values in fields 16 and 18 of the Get_Power_Supply_Data response datagram are valid, and that fields 17 and 19 should be discarded. **3** = battery string "B" current only is measured. Indicates that the values in fields 17 and 19 of the Get_Power_Supply_Data response datagram are valid, and that fields 16 and 18 should be discarded. **4** = battery strings "A" and "B" are measured with separate sensors. Indicates that the values in fields 16, 17, 18 and 19 of the Get_Power_Supply_Data response datagram are all valid

Field #	Field name	Range	Description
10	Float current	1-4	Same format as “battery current”. Values are enumerated as follows: **1** = No float current measurements. Discard associated values in fields 26 and 27 of the Get_Power_Supply_Data response datagram. **2** = Battery string “A” float current only is measured. This setting also applies to a single current sensor set-up to measure the sum of both battery strings “A+B”. Indicates that the value in field 26 of the Get_Power_Supply_Data response datagram is valid, and that field 27 should be discarded. **3** = Battery string “B” float current only is measured. Indicates that the value in field 27 of the Get_Power_Supply_Data response datagram is valid, and that field 26 should be discarded. **4** = Battery strings “A” and “B” are measured with separate sensors. Indicates that the values in fields 26 and 27 of the Get_Power_Supply_Data response datagram are valid
11	Output voltage	1,2	Defines if power supply supports monitoring of output voltage **1** = No support. Discard associated value in field 1 of the Get_Power_Supply_Data response datagram. **2** = Field is supported in this installation. Indicates that the value in field 1 of the Get_Power_Supply_Data response datagram is valid
12	Input voltage	1,2,3	Defines if power supply supports monitoring of input or line voltage **1** = No support. Discard associated data in field 7 of the Get_Power_Supply_Data response datagram. **2** = Field is supported – binary representation. Indicates that field 7 of the Get_Power_Supply_Data response datagram contains valid data. **3** = Field is supported – analogue representation. Indicates that field 7 of the Get_Power_Supply_Data response datagram contains valid data
13	Power supply test	1,2	Defines if power supply supports the remote test feature: **1** = function not supported. **2** = function is supported
14	Major alarm	1,2	Defines if the power supply supports the major alarm indicator: **1** = no support. Discard associated value in field 23 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that field 23 of the Get_Power_Supply_Data response datagram contains valid data
15	Minor alarm	1,2	Defines if the power supply supports the minor alarm indicator: **1** = no support. Discard associated value in field 24 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that field 24 of the Get_Power_Supply_Data response datagram contains valid data
16	Tamper	1,2	Defines if the enclosure door switch is installed in this location: **1** = no support. Discard associated value in field 25 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that field 25 of the Get_Power_Supply_Data response datagram contains valid data
17	Battery monitoring	1,2,3	Defines support level for battery voltage monitoring **1** = no battery voltage is monitored. Discard associated values in fields 8, 9, 10, 11, 12, 13, 14, 15 and 28 of the Get_Power_Supply_Data response datagram. **2** = ONLY full string battery voltage is reported. Indicates that the value in field 28 of the Get_Power_Supply_Data response datagram is valid, and that fields 8, 9, 10, 11, 12, 13, 14 and 15 should be discarded. **3** = individual battery voltages are reported. Full string voltage is also reported. Indicates that fields 8, 9, 10, 11, 12, 13, 14, 15 and 28 of the Get_Power_Supply_Data response datagram are all valid

Field #	Field name	Range	Description
18	Output power	1,2	Defines if the output power is reported: **1** = no support. Discard associated value in field 30 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that the value in field 30 of the Get_Power_Supply_Data response datagram is valid
19	Output frequency	1,2	Defines if the output frequency is reported: **1** = no support. Discard associated value in field 31 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that the value in field 31 of the Get_Power_Supply_Data response datagram is valid
20	Input current	1,2	Defines if the input current is reported: **1** = no support. Discard associated value in field 32 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that the value in field 32 of the Get_Power_Supply_Data response datagram is valid
21	Input power	1,2	Defines if the input power is reported: **1** = no support. Discard associated value in field 33 of the Get_Power_Supply_Data response datagram. **2** = field is supported in this installation. Indicates that the value in field 33 of the Get_Power_Supply_Data response datagram is valid
22	Frequency	1,2	Defines input frequency of power supply: **1** = 50 Hz **2** = 60 Hz

[1] Field entries 1 through 4 are defined in Table 11 and are common to all monitored devices.

[2] Power supply specific fields have limited ranges due to physical limitations. Extensions to this range or additional fields can be accommodated in future versions of this protocol if required.