# DP-7B Integration and Operation

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Automated Systems Engineering, Inc.

The DP-7B Control/Status Panel has been developed to provide a local point for control and monitoring of attached deicing system. The DP-7B also provides an M&C interface for earth station controllers or building automation systems. This document provides installation, configuration, and operational procedures. It also presents M&C protocol information needed to properly develop device drivers.

1. Overview:

The DP-7B is an EIA 1U panel designed for installation into a standard electronic equipment rack. A universal 100-240VAC to 5VDC power supply is included for powering the unit. This power supply connects via a polarized plug to J1 on the back of the unit. Two terminal blocks are used for connection of the DP-7B to the deicing controller, heater, and, optionally, the user's M&C system.

The DP-7B sends commands to and retrieves status from the sensor/controller via a dedicated 5-wire interface. Status is presented to the user by the front panel indicators.
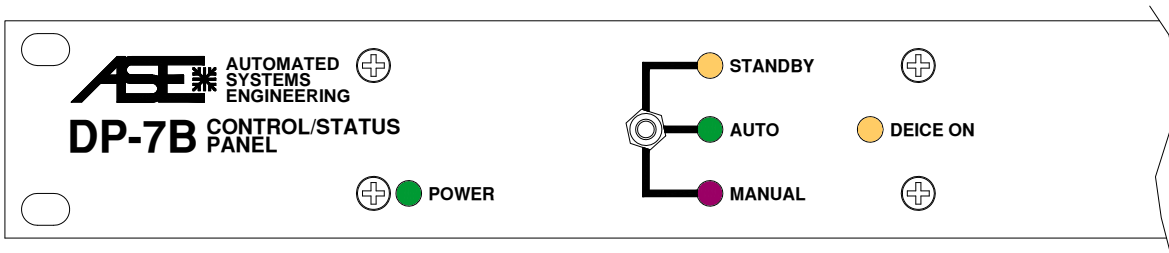
1.1. Controls and Indicators

The following controls and indicators are present on the DP-7B panel:

Indicator	Steady	Flashing
POWER	Power has been applied to the DP-7B.	N/A
STANDBY	The deicing sensor has been placed in "Standby" mode by the front panel switch, clearing a triggered sensor and prohibiting automatic deicing system activation.	The deicing sensor has been placed in "Standby" mode by the M&C system, clearing a triggered sensor and prohibiting automatic deicing system activation.
AUTO	The deicing sensor has been placed in "Automatic" activation mode, ready to detect snow and ice.	N/A
MANUAL	The deicing sensor has been placed into "Manual On" mode by the front panel switch, activating the deicing system.	The deicing sensor has been placed into "Manual On" mode by either the Remote Manual On input or the M&C system, activating the deicing system.
DEICE ON	The deicing sensor is activated.	The deicing sensor is activated and the optional heater on input is triggered.

The DP-7B also provides a dry contact output that will close when the deicing system activates, either from sensing of snow and ice or in response to a Manual On command. A Remote Manual On input is provided for connecting an external dry contact. When closed the DP-7B will place the sensor into a Manual On mode and activate the deicing system. An optional Heater Monitor input is also provided for connecting an external dry contact. When the deicing system is active (DEICE ON) the input will be checked and, if closure is detected, the DEICE ON indicator will flash and the SYSTEM ON monitor bit in the M&C stream will be set. This input can be connected to a current monitoring relay or a thermostat switch to provide feedback that the deicing system is truly operating. Note that there is no requirement to use this input, however.

2. Installing the DP-7B:

Mount the DP-7B into a 1U space by installing screws in each corner of the panel. Terminal block TB-1 is used for interfacing the DP-7B to the deicing sensor. Connect following the table:

DP-7B	Function	DS-2C/5C/9C		DS-2B/224		DS-4/4C/7C	
TB-1		TB-2		J3	CS-1	J3/J4	CS-3/CS-4
Pos 1	Sensor Monitor	MONA	RED	4	RED	J4-1	CS-4 BLK
Pos 2	Sensor Monitor	MONB	ORG	3	ORG	J4-2	CS-4 RED
Pos 3	Sensor Manual On	MAN	BLK	2	BLK	J3-2	CS-3 BLK
Pos 4	Sensor Standby	STBY	GRN	1	GRN	J3-1	CS-3 GRN
Pos 5	Sensor Common	CMN	WHT	5	WHT	J3-5	CS-3 WHT
Pos 6	Rem Deice On Monitor	User Dry Contact Output Monitor Point					
Pos 7	Rem Deice On Monitor	User Dry Contact Output Monitor Point					
Pos 8	Rem Manual On	User Dry Contact Input Control Point					
Pos 9	Rem Manual On	User Dry Contact Input Control Point					

The Rem Deice On Monitor outputs are a dry contact set that is normally open and will close when the deicing sensor has been activated. Contact rating is 24VAC/VDC maximum, 400mA maximum, 10W maximum. Providing a dry contact closure across the Rem Manual On inputs will trigger an external Manual On command.

Terminal block TB-2 is used for interfacing the DP-7B to the M&C system and to an optional heater monitor input.

Note that an external M&C connection is optional and is <u>not</u> required for proper operation. **Be sure that the M&C address has been configured before connecting the DP-7B to the network. See Chapter 3 below.**

A heater monitor can be configured using the TB-2 inputs at positions 1 and 3. When the deicing sensor is activated, indicated by a closure across the Sensor Monitor inputs and a DEICE ON indication, the DP-7B will also check the Heater Monitor inputs for a closure. If one exists the DP-7B will flash the DEICE ON indicator and set the System On (SO) bit in the M&C response, indicating that "system on" feedback has been detected. This input could be used to monitor a thermal switch on the heated device, to check the status of a contactor or a current-sensing relay for proper power, etc. **Note that this input must be a dry contact with absolutely no power supplied on the leads.** The DP-7B will not monitor this input when the sensor is not activated. Therefore, a thermal switch input that would normally close on a warm day with the system off will **not** cause a false System On indication.

DP-7B TB-2	Function
Pos 1	Optional Heater Monitor
Pos 2	Do Not Connect
Pos 3	Optional Heater Monitor
Pos 4	Data Out +
Pos 5	Data Out -
Pos 6	Data In +
Pos 7	Data In -

Insert the polarized power supply plug into J1 on the back of the unit to power the unit on.

3. Configuring the DP-7B:

3.1. Setting the M&C Address:

The DP-7B can provide an addressed 4-wire RS-485 "party-line" M&C interface. The DP-7B will float its common transmit line and continuously "listen" to the receive line. A unique port address in the range 51H to 6FH is included in each packet sent from the M&C system to the DP-7B. If a packet is received that contains

both the correct address and passes a checksum validation the DP-7B will sieze the common transmit line, return the requested information, then release the line.

The data rate for the DP-7B is fixed at 9600 bps. The format conforms to the SABus parameters of 7 data bits, even parity, and 1 stop bit. The port address for the DP-7B is set using the six-position DIP switch on the rear of the unit. Switch 6 is the least significant bit of the address and switch 2 is the most significant bit. All switches "OFF" equates to a binary value of "00000" or 00H. All switches "ON" equates to a binary value of "11111" or 1FH. **Setting all switches "OFF" disables the M&C section of the DP-7B.** A value of 50H is added to the remaining values internally to promote them to a range of 51H to 6FH. Note that this switch is only read at power up. If the address switches are changed the unit must be power cycled for the new address to take effect.

2	3	4	5	6	Bin Value	Hex Value	Address	Note
OFF	OFF	OFF	OFF	OFF	00000	00H	N/A	M&C Disabled
OFF	OFF	OFF	OFF	ON	00001	01H	51H	4-wire RS-485
OFF	OFF	OFF	ON	OFF	00010	02H	52H	4-wire RS-485
▼	▼	▼	▼	▼	▼	▼	▼	▼
ON	ON	ON	ON	OFF	11110	1EH	6EH	4-wire RS-485
ON	ON	ON	ON	ON	11111	1FH	6FH	4-wire RS-485

Switch 1 is used to connect a 120Ω terminating resistor across the receive lines of the M&C interface. Typically, this should only be set on the one unit in a network physically located furthest from the host. Multiple units with termination set will cause unneccessary loading on the data lines and may compromise reliability of the network.

4. Operating the DP-7B:

Apply power to the attached deicing sensor, then the DP-7B. The user can then observe the front panel DEICE ON indicator to determine the status of the deicing system. The MANUAL control switch allows the user to manually activate the deicing sensor. Placing the switch in STANDBY will prohibit automatic activation and clear any remaining delay off time on a triggered sensor. Normally, this switch should be left in the AUTO position to allow automatic activation.

5. DP-7B Remote M&C Protocol

The DP-7B should be configured for M&C interface as required by following the steps outlined in Section 3.1. To maintain compatability with numerous earth station controllers SAbus protocol is used. Data format is 9600 bps, 7 data bits, even parity, and 1 stop bit.

5.1. Character Recognition

The DP-7B can recognize all printable ASCII characters and four non-printable ASCII characters. The only exception to this is in the case of the calculated LRC value for error detection. Printable ASCII characters range from 20H to 7FH and non-printable characters range from 00H to 1FH.

The printable ASCII characters are used for transmission of controller identity, command and monitor bytes, and device information. The four non-printable characters are used for handshaking information and consist of:

STX	02H	Start-Of-Text
ETX	03H	End-Of-Text
ACK	06H	Acknowledge
NAK	15H	Not Acknowledge

5.2. Message Protocol

The station controller (host) initiates communications by sending a handshaking sequence including a start-of-text (STX) and identity address, then a command to the DP-7B. If the address is correct and the checksum is valid the DP-7B will respond as required according to the command sent. Until a valid handshaking sequence is

received, the DP-7B will remain "off-line" to allow other devices to communicate with the host when operating in RS-485 mode.

Host	STX	Identity Address	Command Num	Data	ETX	Checksum
DP-7B	ACK	Identity Address	Echoed Command Num	Data	ETX	Checksum

The checksum used for data transfer is a longitudinal redundancy check or LRC. It is calculated by XOR'ing all bytes in the packet. The easiest method of calculating and comparing upon reception is to XOR the entire packet, then XOR the result with the LRC checksum. The result should be 0 (zero).

If a command string is received from the host, is parsed, and is found to have an incorrect checksum the DP-7B will <u>not</u> respond. It is possible that the corruption occurred due to an improperly transmitted identity. Therefore, if the unit did respond it could collide with the return data from a properly addressed unit.

5.3. Device Type and Revision Level Query

Data	Format	Bytes	7	6	5	4	3	2	1	0
STX	02H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	30H	1								
ETX	03H	1								
LRC	xxH	1								

Data	Format	Bytes	7	6	5	4	3	2	1	0
ACK	06H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	30H	1								
Device	Char	1	Parity				ASCII "D"			
Device	Char	1	Parity				ASCII "P"			
Device	Char	1	Parity				ASCII "7"			
Device	Char	1	Parity				ASCII "B"			
Major Rev	Char	1	Parity				[1]ASCII "1"			
Minor Rev	Char	1	Parity				[1]ASCII "0"			
ETX	03H	1								
LRC	xxH	1								

[1]These values will change as software is revised.

5.4. Device Status Query

Data	Format	Bytes	7	6	5	4	3	2	1	0
STX	02H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	31H	1								
ETX	03H	1								
LRC	xxH	1								

Data	Format	Bytes	7	6	5	4	3	2	1	0
ACK	06H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	31H	1								
Status	Bitset	1	Parity	1	MMO	MSB	RMO	LMO	LSB	DO
Status	Bitset	1	Parity	1	MOM	AM	SBM	0	SO	0
ETX	03H	1								
LRC	xxH	1								

DO = Deice On Status
LSB = Local Standby Command
LMO = Local Manual On Command
RMO = Remote Manual On Command
MSB = M&C Standby Command
MMO = M&C Manual On Command
SO = System On Status (Deice On & Heater Monitor)
SBM = Standby Mode Status
AM = Automatic Mode Status
MOM = Manual On Mode Status

5.5. Device Command and Status Query

Data	Format	Bytes	7	6	5	4	3	2	1	0
STX	02H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	32H	1								
Command	Bitset	1	Parity	1	0	0	0	0	MMO	MSB
ETX	03H	1								
LRC	xxH	1								

Data	Format	Bytes	7	6	5	4	3	2	1	0
ACK	06H	1								
Identity	Byte	1	Parity				51H-6FH			
Cmd Num	32H	1								
Status	Bitset	1	Parity	1	MMO	MSB	RMO	LMO	LSB	DO
Status	Bitset	1	Parity	1	MOM	AM	SBM	0	SO	0
ETX	03H	1								
LRC	xxH	1								