METTLER TOLEDO

IND780com
Terminal
and
COM-780
Software Module
Technical Manual

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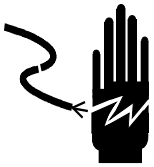

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WARNING!

NOT ALL VERSIONS OF THE IND780 ARE DESIGNED FOR USE IN HAZARDOUS (EXPLOSIVE) AREAS. REFER TO THE DATA PLATE OF THE IND780 TO DETERMINE IF A SPECIFIC TERMINAL IS APPROVED FOR USE IN AN AREA CLASSIFIED AS HAZARDOUS BECAUSE OF COMBUSTIBLE OR EXPLOSIVE ATMOSPHERES.

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Chapter 1

Introduction

Overview

The **IND780com** industrial terminal is a single- or multi-range, high-performance weighing terminal for use with analog, METTLER TOLEDO POWERCELL®/MTX®, IDNET and/or SICS scale bases. It is a specialized solution focused on the needs of users using legacy host serial communication protocols. The IND780com may be used with up to four platforms connected and a Sum Scale. It allows the host device (e.g. PC or PLC) access to the weight, status and functions of any configured scales. The **Com-780 Software**, enabled by the installation of a hardware key, augments the basic functionality of the IND780 with a variety of host communication protocols.

In general, the IND780com terminal functions, and is configured in the same way as, the IND780 with basic functionality. This document details only those aspects of function and configuration specific to the Com-780 software. Detailed information about common features of the terminal may be found in the IND780 **User's Guide**, **Installation Manual** and **Technical Manual**.

The IND780com's features include:

- 8142 host protocol with multiplex communications for multiple scales
- 8530 host protocol with multiplex communications for multiple scales
- PT6S3 host protocol
- SMA (Scale Manufacturers Association) scale communication protocol
- Protocols individually supported on any available serial port (RS-232 or RS-422/ 485) on COM1 – 4

This chapter provides an overview of IND780com functionality.

Model Identification

Figure 1-1 explains the model numbers used to define and identify the hardware and software configuration of an IND780.

The Com-780 or TaskExpert/Com-780 (option 2 or 3) module is not available when any Application Software option is present (i.e., Application Software code must be 0).

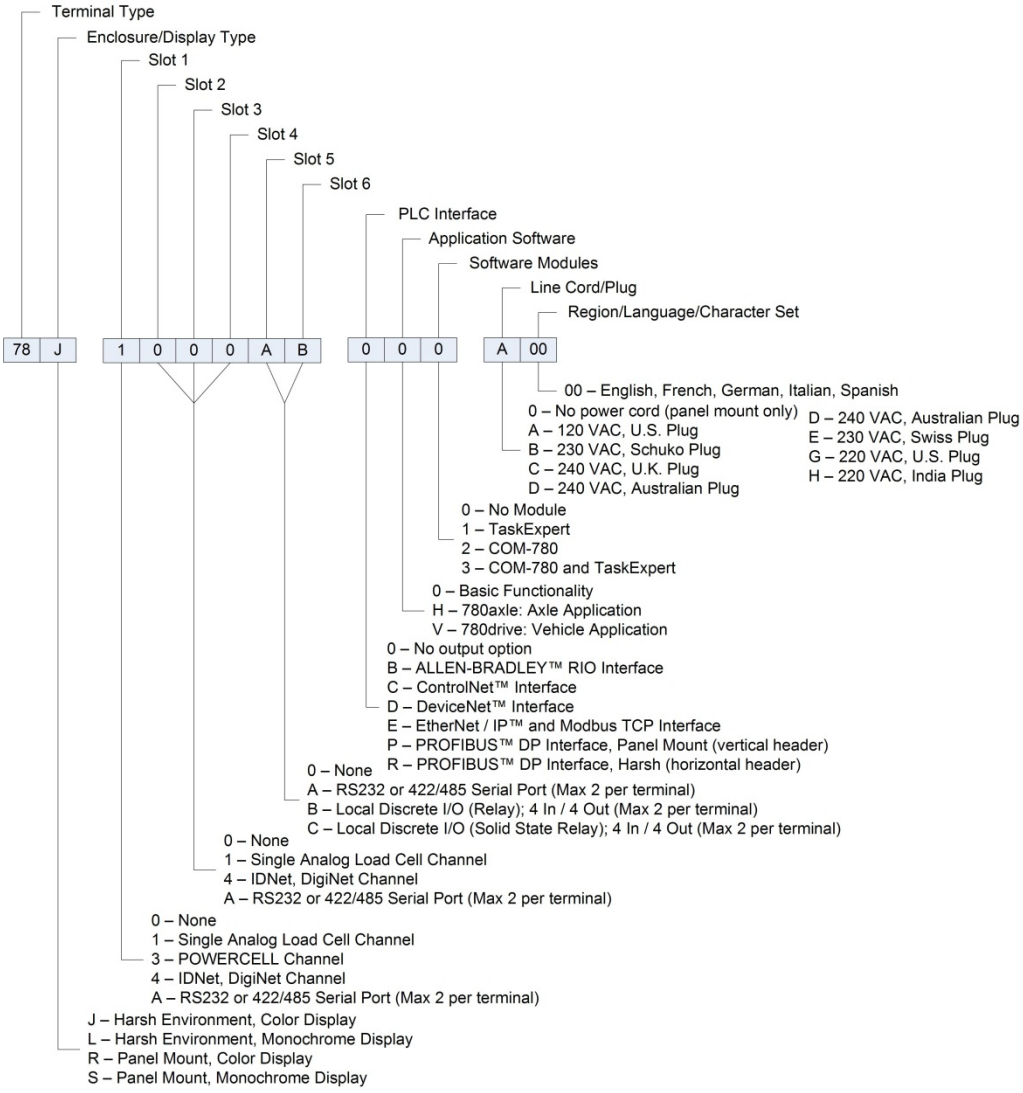

Figure 1-1: Model Configuration Numbers

Basic Capabilities

Each of the following functions is described in detail in Appendixes D, E, F and G. The IND780com may be configured to enable any one of these functions in Setup at Communications > Connections.

8142 Host Mode

Primarily used in METTLER TOLEDO legacy industrial terminals such as the 8142 and LYNX®. Host computers can use this protocol to read or write specific scale and terminal data using designated Hex or ASCII function codes. For example, the remote host computer could read a specific scale's displayed, gross, tare or net weight from the terminal and it could write to the scale's active target value or next sequential number. Access to status and control bytes allows the host computer to monitor and control the operation of a specific scale.

The 8142 protocol is suitable for either single or multiple scale applications. By assigning each local scale in the terminal with a unique node address, the host device can get access to any specific scale using one of the available types of serial interface (RS-232, RS-422 or RS-485). Additionally, when the RS-485 interface is used, several terminals can be connected to a single host device in a multi-drop network. The maximum number of scales or address nodes in the network is 8.

8530 Host Mode

Primarily used in METTLER TOLEDO legacy industrial terminals such as the 8530, COUGAR™ and LYNX®. With this protocol host computers can read or write specific scale and terminal data using designated Hex or ASCII function codes. For example, the remote host computer could read a specific scale's displayed, gross, tare or net weight from the terminal and it could write to the scale's active target value or next sequential number. Access to status and control bytes allows the host computer to monitor and control the operation of a specific scale.

The 8530 protocol is suitable for either single or multiple scale applications. By assigning each local scale in the terminal with a unique node address, the host device can get access to any specific scale using one of the available types of serial interface (RS-232, RS-422 or RS-485). Additionally, when the RS-485 interface is used, several terminals can be connected to a single host device in a multi-drop network. The maximum number of scales or address nodes in the network is 8.

PT6S3 Protocol

PT6S3 is a single scale host protocol that also includes the commands of its predecessors, notably PT6S2, the most common, in order to maintain full compatibility of the functions. This protocol allows the replacement of an old model indicator in an existing installation. The host device typically issues an individual ASCII character command to retrieve certain scale data such as the displayed

weight or the scale capacity from the IND780com.Tare, clear tare, zero and print functions are also supported.

SMA Protocol

The Scale Manufacturers Association (SMA) has defined a Scale Serial Communication Protocol standard in order to facilitate a common communications architecture for weighing scale instruments across all scale vendors and manufacturers. The protocol is based on a Command/Response method where the commanding host device is responsible for issuing specific ASCII character commands to request certain scale data or to perform a terminal function. The IND780com supports the entire Level #1 command set and certain Level # 2 commands, as defined by the SMA document SMA SCP-0499 (rev 1, November 2005).

The IND780com terminal running the SMA protocol allows the host device access to a single scale through an available communications port that has been assigned to this function. The protocol is available on COM1 through COM4 with any type of interface (RS-232, RS-422 or RS-485).

Chapter 2

Operation

Introduction

This chapter provides an overview of operations that are specific to the IND780com. Details on basic IND780 functionality may be found in the IND780 **User's Guide** and **Technical Manual**.

Operation of the terminal depends on enabled functions and setup parameters. Functionality and configuration parameters are programmed in Setup and can be modified as necessary by users with appropriate access levels.

Figure 2-1 shows an IND780com Home screen, with a single scale display. There is no difference in the Home screen display between a standard IND780 and an IND780com. All display settings such as SmartTrac are configured in Setup.

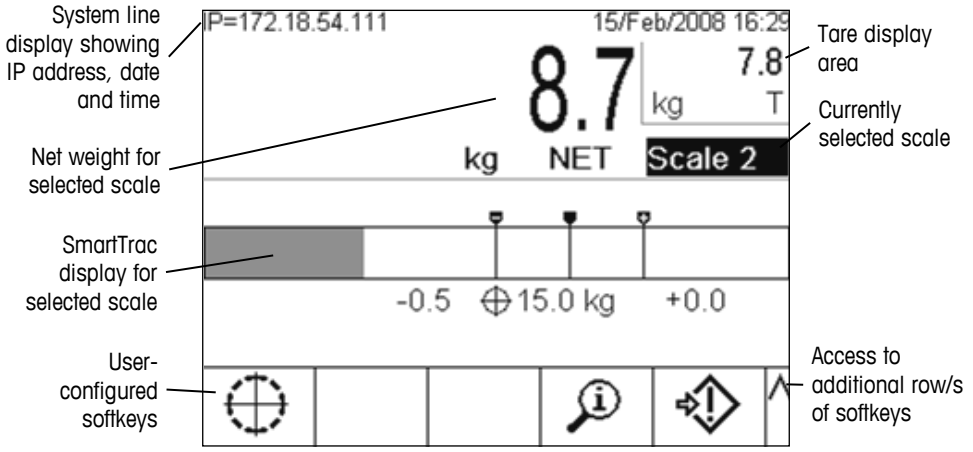

Figure 2-1: Elements of the Home Screen

- The softkeys visible in the screen shown in Figure 2-1 are determined in Setup. Available softkeys will vary between terminals.

Security

The IND780com supports the use of usernames and passwords for four levels of setup security. Refer to the IND780 Technical Manual Appendix B, Default Settings, to determine security levels assigned to specific parameters in setup.

- **Administrator**—An Administrator account has unlimited access to all areas of the operating and setup system. There can be multiple Administrator accounts, including one Primary Administrator account, which can be changed but never deleted. As configured at the factory, the Primary Administrator account has no password. This default configuration requires no login or password entry to enter the setup mode. All functions of the terminal are available to all users until a password for the Primary Administrator account is set up.

  When the Metrology switch is set to "on", all users with Administrator rights are reduced to the Maintenance level. This is done to protect metrologically significant parameters that cannot be changed when the terminal is "approved."

  Once a password is set up, be sure to remember it. If the password is changed or forgotten, access to the setup menu will not be available. Be sure to protect the password from access by unauthorized personnel. The password provides access to the entire setup menu, unless the metrology switch is placed in the approved position.

- **Maintenance**—Access is generally the same as the Administrator level with the exception of access to metrologically significant areas of the setup.
- **Supervisor**—Access is generally limited to editing tables and setting time and date.
- **Operator**—One default operator account is provided. Sites with validation requirements might create many operator accounts, each with a username and password entry requirement. The Operator-class of security is the most restrictive, allowing the user to use and view, but not change, records within tables.

If a password has been programmed for the default Administrator username in Setup, and all other users have a password assigned, a login screen is presented whenever the Setup softkey is pressed. A valid username and password must be entered. Depending on the access level of the user logged in, setup screens may be visible only, or visible and available for modification.

If a login fails, the display exits the login page and returns to the home screen.

Basic Operation

Each of the following types of basic operation must be enabled in Setup. Any available serial communication port (COM1 – COM4), can be assigned with the type of protocol required to communicate with the host device. Refer to Chapter 3 of this manual for the available configuration options.

8142 Host Mode

The 8142 host protocol uses specific function code commands to request scale information, trigger basic scale functions and also download weight values to the IND780 terminal. The terminal will never perform an operation or respond without a valid command from the host.

The protocol data format typically requires the host to specify the address of the scale it is trying to access, the direction of the data transfer and the appropriate function code. The codes for the various supported functions are listed in Table 2-1 with the valid direction of the communication (**U**pload from the IND780 or **D**ownload to the IND780). Further details on the 8142 host protocol can be found in Appendix D.

Table 2-1: 8142 Function Code Table

Function Code Description	Function Code		Direction
	Hex	ASCII	
All Functions	41	A	U
Displayed Weight	42	B	U
Gross Weight	43	C	U
Tare Weight	44	D	U/D
Net Weight	45	E	U
Time and Date	46	F	U/D
Next Sequential Number	47	G	U/D
Clear Last Printed Data from Memory	48	H	D
Status Bytes	49	I	U
Control Bytes	4B	K	D
Active Target	4C	L	U/D
Active Target, Fine Feed, Spill, Tolerance	4E	N	U/D
Last Printed Data from Printer Port	51	Q	U
Sub-Total Accumulator	54	T	U
Total Accumulator	55	U	U

8530 Host Mode

The 8530 host protocol uses specific function code commands to request scale information, trigger basic scale functions and also download weight values to the IND780 terminal. The terminal will never perform an operation or respond without a valid command from the host.

The protocol data format typically requires the host to specify the address of the scale it is trying to access, the direction of the data transfer and the appropriate function code. The codes for the various supported functions are listed in Table 2-2 with the valid direction of the communication (upload from the IND780 or download to the IND780). Further details on the 8530 host protocol can be found in Appendix E.

Table 2-2: 8530 Function Code Table

Function Code Description	Function Code		Direction
	Hex	ASCII	
Read All Functions	41	A	U
Displayed Weight	42	B	U
Gross Weight	43	C	U
Tare Weight	44	D	U/D
Net Weight	45	E	U
Time and Date	46	F	U/D
Next Sequential Number	47	G	U/D
Status Bytes	49	I	U
Control Bytes	4B	K	D
Active Target	4C	L	U/D
Subtotal Accumulator	51	Q	U
Total Accumulator	52	R	U

PT6S3 Protocol

The PT6S3 protocol consists of a set of single ASCII character host commands to request scale information and trigger basic scale functions. The PT6S2 set of commands are also accepted by the PT6S3 protocol. The terminal provides some error detection capabilities by including a checksum in the response frame and also an error response to unknown commands it receives.

Table 2-3 shows the various valid PT6S3 and PT6S2 host commands accepted by the IND780 terminal. Further details on the PT6S3 host protocol can be found in Appendix F.

Table 2-3: PT6S3 and PT6S2 Supported Commands

Command Description	PT6S2 Commands		PT6S3 Commands	
	Hex	ASCII	Hex	ASCII
Request For Displayed Weight	50	P	70	p
Request To Zero Scale	4D	M	6D	m
Request To Tare or Clear Tare	54	T	74	t
Request To Clear Tare	52	R	72	r
Request to Tare Scale	-	-	6E	n
Request Metrological Parameters	-	-	67	g
Request Minimum Scale Capacity	-	-	7A	z
Request Maximum Scale Capacity	-	-	77	w
Request For Print, Displayed Weight And Transaction Number	-	-	71	q

SMA Protocol

The SMA host protocol uses specific function code commands to request for scale information and trigger basic scale functions on the IND780 terminal. The terminal provides some error detection capabilities by including error responses to unknown commands it receives.

The IND780 supports all Level #1 SMA commands and certain Level #2 commands. Table 2-4 shows the various valid SMA host commands accepted by the IND780 terminal. Further details on the SMA host protocol can be found in Appendix G.

Table 2-4: SMA Function Code Table

Function Code Description	Level	Function Code	
		Hex	ASCII
Request Displayed Weight	1	57	W
Request High Resolution (x10) Weight	2	48	H
Request Displayed Weight After Stability	2	50	P
Request High Resolution Weight After Stability	2	51	Q
Request To Zero Scale	1	5A	Z
Request To Tare Or Preset Tare Scale	2	54	T
Return Tare Weight	2	4D	M
Clear Scale Tare Weight	2	43	C
Change Units Of Measure	2	55	U
Invoke Scale Diagnostics	1	44	D
About Scale Data (First line)	1	41	A
About Scale Data (Scroll)	1	42	B
Scale Information (First line)	2	49	I
Scale Information (Scroll)	2	4E	N
Abort Command	1	1B	ESC
Repeat Displayed Weight Continuously	2	52	R
Repeat High Resolution Weight Continuously	2	53	S

Chapter 3

Configuration

Installing the Hardware Key

The hardware key which enables Com-780 functionality must be installed in a socket on IND780 main PCB. Access to the main PCB varies depending on whether the enclosure is the Panel Mount or Harsh model.

- When the IND780 terminal is restarted after the hardware key is installed or removed, a Master Reset is required and all configuration settings and files except metrologically significant scale data are restored to their factory defaults. Any information stored in user-configured tables such as targets and tare weights will be lost. This information can be saved by performing a Backup to USB operation before installing the hardware key. Refer to Chapter 4, **Service and Maintenance**, of the **IND780 Technical Manual** for the procedure to follow. Calibration data will not be affected.
- The features and functions unique to the Com-780 module require a terminal running firmware version 5.1 or higher. For instructions on how to upgrade the firmware in an IND780 terminal, please refer to Chapter 4, **Service and Maintenance**, of the **IND780 Technical Manual**.

To install the hardware key:

1. Remove power from the terminal.
2. Access the Main PCB:
    A. For a Panel Mount unit, remove the four screws that fasten the back cover to the enclosure.
    B. For a Harsh unit, remove the front panel using a flat blade screwdriver, as described in **Appendix A**, **Installation**, of the IND780 **Technical Manual**.

3. Identify the hardware key socket, adjacent to the main PCB backup battery. The socket is indicated in Figure 3-1.

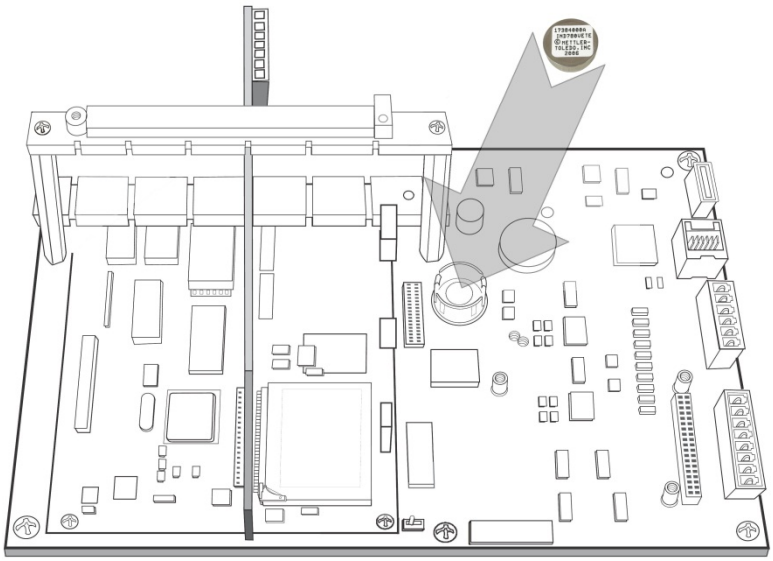

Figure 3-1: Hardware Key Socket

4. Position the hardware key in the socket, label-side up. Press it down into the socket until the two retaining clips snap into position, as shown in Figure 3-2.

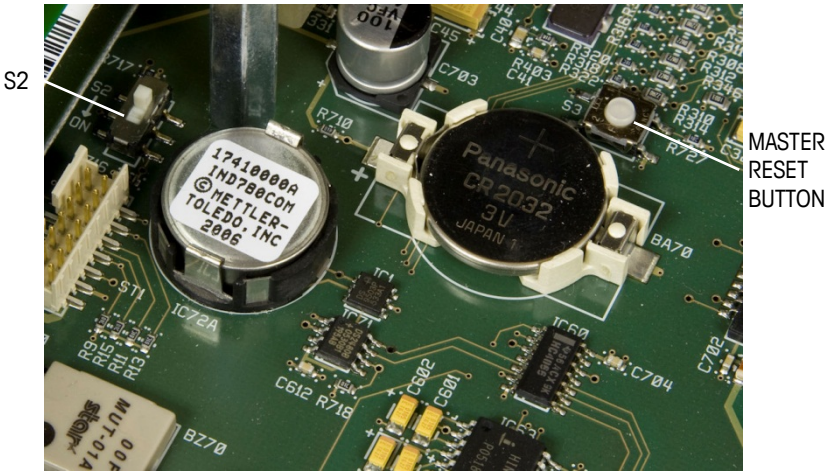

Figure 3-2: Hardware Key Installed

5. Note that, when the terminal is restarted, a Master Reset must be performed by holding down the Master Reset button (indicated in Figure 3-2) when power is applied, until the terminal beeps.

- The Master Reset operation will not reset metrologically significant scale configuration data unless S2 (shown in its OFF position in Figure 3-2) is in its ON position when the reset is performed.

Setup Mode

Entering and Exiting Setup Mode

To access the setup menu tree, press the DOWN or UP key, if necessary to display the appropriate row of softkeys, then press the SETUP softkey .

If security is enabled (passwords have been assigned to the default Administrator and Operator), and no log-in is in effect, attempts to access setup will be met with a Login screen (Figure 3-3) that requires the entry of a valid user name and password. Depending on the access level of the login, setup screens may be visible only, or visible and modifiable.

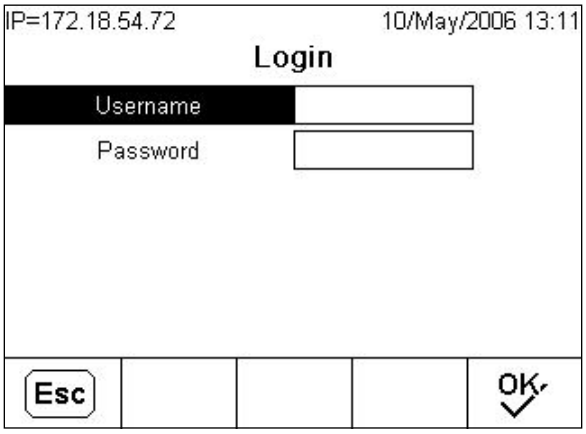

Figure 3-3: Log-In Screen

To leave setup and return to the home screen, either press the first (left-most) softkey while the menu tree is showing, or use the UP key to move focus to the Home branch and then press ENTER.

Com-780 Setup Menu Tree

The setup menu of the Com-780 version of the IND780 includes all the elements and functionality of the default configuration (detailed in Chapter 3, **Configuration**, in the IND780 **Technical Manual**), together with some additional or modified screens. Figure 3-4 shows the tree with new or modified leaf nodes (in the **Communication > Connections** branch of the tree) expanded and shaded. Unchanged branches are shown unexpanded. The functions and parameters of each of the affected screens are detailed in the Configuration Options section, immediately below.

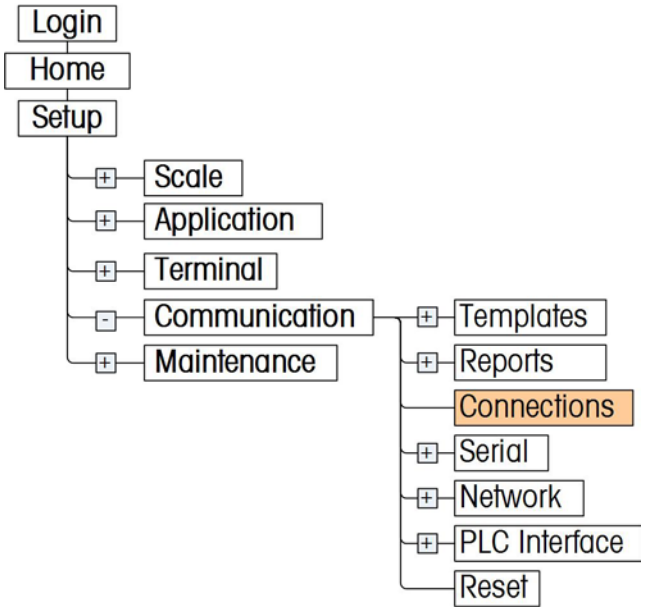

Figure 3-4: IND780 Menu Tree: Branches Specific to Com-780

Configuration Options

- In the following sections, default values are indicated with an asterisk (*).

Communication

Connections

The Com-780 module adds new connection assignments that can be used to communicate with host systems using the 8142, 8530, PT6S3 or SMA protocols.

The connections setup screen (Figure 3-5) shows the physical port connections that have been programmed for the terminal. This includes the standard serial ports, COM1 and COM2 and Ethernet ports. The optional COM3 and COM4 ports are only available if the options have been installed. This screen lists the defined connections. If no connections are programmed, nothing will be available on the

COM or Ethernet ports. The Com-780 host protocols are only assignable to the serial ports COM1 through COM4.

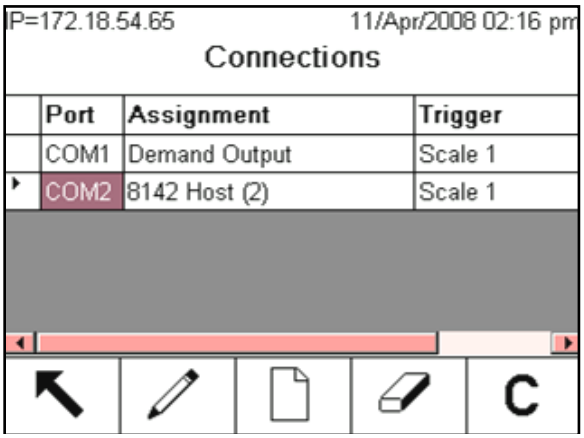

Figure 3-5: Connections Setup Screen

The following functions are available via softkeys on the connections screen:

- Editing
- Deleting
- Inserting
- Clearing

To edit or insert connection assignments:

1. Press the UP and DOWN navigation keys to select (highlight) a connection assignment in the list.
2. Press the EDIT softkey to open the screen for editing a specific connection assignment or press the NEW softkey to create a new connection assignment.

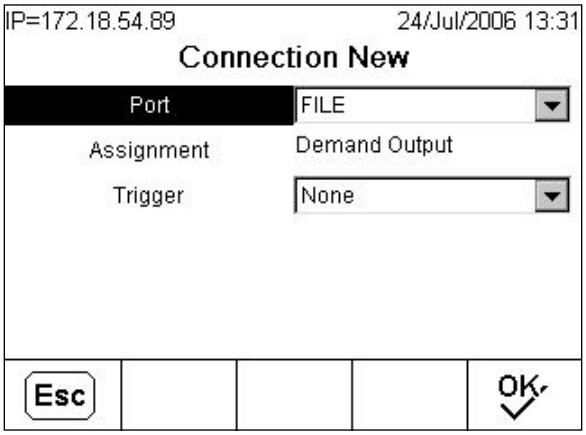

Figure 3-6: Connection New Setup Screen

Parameters that are configured in the connections screen include the port and the type of input or output assignment. Depending upon these selections, the remaining fields will vary but could include the trigger, the node address and whether the checksum will be sent or not.

3. Press the UP and DOWN navigation keys to move the focus to the fields to be edited or added.
4. Press the ENTER key to select a field to edit or add.
5. Use the selection boxes for each field to select the port, associated assignment, and desired settings for the connection. Specific selections included with the IND780com are shown in the table below.

- Specific details of the 8142, 8530, PT6S3 and SMA host protocol assignments can be found in Appendices D, E, F and G of this manual.
- A port may be used by more than one 8142 or 8530 connection, but different types of host protocols cannot share the same port.

Table 3-1 shows the various configuration options available when defining a IND780com host protocol connection. Blank cells indicate settings that are not applicable to the assignment. The configuration options for the standard IND780 are not shown here; they are described in Chapter 3, **Configuration**, in the IND780 **Technical Manual**.

Table 3-1: Connection Options Specific to IND780com

Port	Assignment	Trigger	Template	# of Nodes	Node Address	Checksum
COM1 COM2 COM3 COM4	None*					
	8142 Host	Scale 1* – Scale 4, Sum Scale			2* - 9	Disabled*, Enabled
	8530 Host					
	PT6S3	Scale 1* – Scale 4, Sum Scale				
	SMA	Scale 1* – Scale 4, Sum Scale				

- The Trigger field sets the scale channel that is associated with the connection.
- The Node Address field (only available to the 8142 or 8530 Host) allows the terminal to associate the connection with a unique node address that the host device can identify and access. Up to 8 node addresses can be assigned in the host system and the valid address range is from 2 - 9.
- The Checksum selection field is available for the 8142 and 8530 Hosts only.
- It is not possible to assign more than one PT6S3 or SMA connection to the same port.

6. Press the OK softkey OK to accept the connection parameters and return to the Connections setup screen when editing or adding the connection assignment is complete.
7. Press the ESCAPE softkey Esc to discard the connection parameters and return to the Connections setup screen without saving the connection assignment edits or additions.
8. Press the DELETE softkey to delete a connection assignment from the Connections list.

9. Press the CLEAR softkey C to clear all connection assignments in the Connections list.
10. Press the EXIT softkey ↖ to return to the menu tree.

Appendix A

Serial Communications

Serial Interface Parameters

The IND780 supports two standard and two optional serial ports. They are designated COM1 and COM2 (standard ports on the main PCB), COM3 and COM4 (optional).

COM1 provides an RS-232 interface, three-wire (TxD, RxD, and GND) with XON/XOFF flow-control capabilities (handshaking).

COM2 can be configured as an RS-232, RS-422 or RS-485 interface. The RS-422 interface is a four-wire interface designed for single point-to-point communication. When COM2 is configured as an RS-422 port, the Transmit line is "On," even when no data is being transmitted. This operation is consistent with the standard operation of an RS-422 port, but differs in function from many legacy Mettler Toledo terminals. If compatibility with the "multi-drop" mode of operation for an RS-422 port is required, select RS-485 as the Interface Type and connect to the RS-422 connections.

Optional **COM3** and **COM4** provide RS-232, RS-422, and RS-485 interfaces. The RS-422 and RS-485 interfaces of the IND780, when used in conjunction with the 8142 Host Protocol or 8530 Host Protocol, provide a master/satellite protocol to permit up to eight (8) IND780s to be connected in a daisy chain network to a single host device. At Communication > Connections setup, each IND780 with its local scale can be assigned a unique node address (2 through 9) to distinguish one IND780 scale from another.

Alternatively, the RS-232 interface can be used to connect one IND780 to one host computer using the same 8142 or 8530 protocol as the multi-drop interface to communicate with all of the IND780 terminal's local scales. The total number of node addresses supported by the protocol in any case is limited to 8.

Character framing is programmable in the setup mode. Framing can be:

- 1 start bit
- 7 or 8 ASCII data bits (selectable)
- 0 or 1 parity bit (none, even, or odd)
- 1 stop bit

The baud rate can be configured from 300 to 115.2K baud and a checksum character can also be configured for the 8142 or 8530 Host.

To control data flow, the IND780 terminal uses software handshaking commonly referred to as XON/XOFF. When a receiving device (typically a printer) is getting information from an IND780 terminal and cannot receive any more in its buffer, it sends an ASCII XOFF (13h) telling the IND780 terminal to stop sending data until its buffer clears.

When the device can receive more data, it sends an ASCII XON (11h) telling the IND780 terminal to begin sending data again. This process can occur as often as required by a receiving device.

Appendix B

Default Settings

This chapter provides details of the default settings of all the IND780com specific setup parameters. Refer to **Appendix B** in the standard IND780 **Technical Manual** for a full listing of all setup parameter default settings.

Setup Feature	Default Value	Security Access
Communication – Connections (default preconfigured connection)		
Port	COM1	Maintenance
Assignment	Demand Output	Maintenance
Trigger	Scale 1	Maintenance
Template	Template 1	Maintenance

Appendix C

ASCII Standard and Control Characters

The following tables list ASCII standard and control characters used by the IND780. The Nul (00 Hex), ^ (5E Hex) and ~ (7E Hex) characters are reserved for use by the operating system of the terminal and they are not directly available to the user.

Table C-1: ASCII Standard Characters

Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.	Dec.	Hex.
NUL	0	00	SYN	22	16	,	44	2C
SOH	1	01	ETB	23	17	-	45	2D
STX	2	02	CAN	24	18	.	46	2E
ETX	3	03	EM	25	19	/	47	2F
EOT	4	04	SUB	26	1A	0	48	30
ENQ	5	05	ESC	27	1B	1	49	31
ACK	6	06	FS	28	1C	2	50	32
BEL	7	07	GS	29	1D	3	51	33
BS	8	08	RS	30	1E	4	52	34
HT	9	09	US	31	1F	5	53	35
LF	10	0A	SP	32	20	6	54	36
VT	11	0B	!	33	21	7	55	37
FF	12	0C	″	34	22	8	56	38
CR	13	0D	#	35	23	9	57	39
SO	14	0E	$	36	24	:	58	3A
SI	15	0F	%	37	25	;	59	3B
DLE	16	10	&	38	26	<	60	3C
DC1	17	11	′	39	27	=	61	3D
DC2	18	12	(	40	28	>	62	3E
DC3	19	13	)	41	29	?	63	3F
DC4	20	14	*	42	2A	@	64	40
NAK	21	15	+	43	2B	A	65	41

Char.	Dec.	Hex.
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D
^	94	5E
_	95	5F
`	96	60
a	97	61
b	98	62
c	99	63
d	100	64

Char.	Dec.	Hex.
e	101	65
f	102	66
g	103	67
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E
o	111	6F
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B
|	124	7C
}	125	7D
~	126	7E
	127	7F
Ç	128	80
ü	129	81
é	130	82
ã	131	83
ä	132	84
à	133	85
å	134	86
ç	135	87

Char.	Dec.	Hex.
	136	88
ë	137	89
è	138	8A
ï	139	8B
î	140	8C
ì	141	8D
Ä	142	8E
Å	143	8F
É	144	90
œ	145	91
Æ	146	92
ô	147	93
ö	148	94
ò	149	95
û	150	96
ù	151	97
_	152	98
ö	153	99
Ü	154	9A
	155	9B
	156	9C
	157	9D
Pt	158	9E
ƒ	159	9F
á	160	A0
í	161	A1
ó	162	A2
ú	163	A3
ñ	164	A4
Ñ	165	A5
	166	A6
	167	A7
¿	168	A8
	169	A9
	170	AA

Char.	Dec.	Hex.
	171	AB
	172	AC
¡	173	AD
«	174	AE
»	175	AF
	176	B0
	177	B1
	178	B2
	179	B3
	180	B4
	181	B5
	182	B6
	183	B7
	184	B8
	185	B9
	194	C2
	186	BA
	187	BB
	188	BC
	189	BD
	190	BE

Char.	Dec.	Hex.
	191	BF
lb	192	C0
	193	C1
	195	C3
oz	196	C4
	197	C5
	198	C6
	199	C7
	224	E0
ß	225	E1
	226	E2
	227	E3
	228	E4
	229	E5
	230	E6
	231	E7
	232	E8
	233	E9
	234	EA
	235	EB
	236	EC

Char.	Dec.	Hex.
	237	ED
	238	EE
	239	EF
_	240	F0
□	241	F1
_	242	F2
	243	F3
Ø	244	F4
ø	245	F5
□	246	F6
	247	F7
°	248	F8
¨	249	F9
	250	FA
§	251	FB
	252	FC
	253	FD
	254	FE
	255	FF

Table C-2: ASCII Control Characters

Char	Definition	Function
SOH	START OF HEADING	A transmission control character used as the first character of a heading of an information message.
STX	START OF TEXT	A transmission control character that precedes a text and that is used to terminate a heading.
ETX	END OF TEXT	A transmission control character that terminates a text.
EOT	END OF TRANSMISSION	A transmission control character used to indicate the conclusion of the transmission of one or more texts.
ENQ	ENQUIRY	A transmission control character used as a request for a response from a remote station; the response may include station identification and/or station status. When a "Who are you" function is required on the general switched transmission network, the first use of ENQ after the connection is established will have the meaning "Who are you" (station identification). Subsequent use of ENQ may, or may not, include the function "Who are you", as determined by agreement.
ACK	ACKNOWLEDGE	A transmission control character transmitted by a receiver as an affirmative response to the sender.
BEL	BELL	A control character that is used when there is a need to call for attention; it may control alarm or attention devices.
BS	BACKSPACE	A format effector that moves the active position one character position backwards on the same line.
HT	HORIZONTAL TABULATION	A format effector that advances the active position to the next pre-determined character position on the same line.
LF	LINE FEED	A format effector that advances the active position to the same character position of the next line.
VT	VERTICAL TABULATION	A format effector that advances the active position to the same character position on the next pre-determined line.
FF	FORM FEED	A format effector that advances the active position to the same character position on a pre-determined line of the next form or page.
CR	CARRIAGE RETURN	A format effector that moves the active position to the first character position on the same line.
SO	SHIFT OUT	A control character that is used in conjunction with SHIFT IN and ESCAPE to extend the graphic character set of the code.

Char	Definition	Function
SI	SHIFT IN	A control character that is used in conjunction with SHIFT OUT and ESCAPE to extend the graphic character set of the code.
DLE	DATA LINK ESCAPE	A transmission control character that will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphic characters and transmission control characters can be used in DLE sequences.
DC1	DEVICE CONTROL ONE	A device control character that is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to restore a device to the basic mode of operation (see also DC2 and DC3), or for any other device control function not provided by other DCs.
DC2	DEVICE CONTROL TWO	A device control character that is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to set a device to a special mode of operation (in which case DC1 is used to restore normal operation), or for any other device control function not provided by other DCs.
DC3	DEVICE CONTROL THREE	A device control character that is primarily intended for turning off or stopping an ancillary device. This function may be a secondary level stop, for example, wait, pause, stand-by or halt (in which case DC1 is used to restore normal operation). If it is not required for this purpose, it may be used for any other device control function not provided by other DCs.
DC4	DEVICE CONTROL FOUR	A device control character that is primarily intended for turning off, stopping, or interrupting an ancillary device. If it is not required for this purpose, it may be used for any other device control function not provided by other DCs.
NAK	NEGATIVE ACKNOWLEDGE	A transmission control character transmitted by a receiver as a negative response to the sender.
SYN	SYNCHRONOUS IDLE	A transmission control character used by a synchronous transmission system in the absence of any other character (idle condition) to provide a signal from which synchronism may be achieved or retained between data terminal equipment.
ETB	END OF TRANSMISSION BLOCK	A transmission control character used to indicate the end of a transmission block of data where data is divided into such blocks for transmission purposes.

Char	Definition	Function
CAN	CANCEL	A character, or the first character of a sequence, indicating that the data preceding it is in error. As a result, this data is to be ignored. The specific meaning of this character must be defined for each application and/or between sender and recipient.
EM	END OF MEDIUM	A control character that may be used to identify the physical end of a medium, or the end of the used portion of a medium, or the end of the wanted portion of data recorded on a medium. The position of this character does not necessarily correspond to the physical end of the medium.
SUB	SUBSTITUTE	A control character used in the place of a character that has been found to be invalid or in error. SUB is intended to be introduced by automatic means.
ESC	ESCAPE	A control character that is used to provide additional control functions. It alters the meaning of a limited number of contiguously following bit combinations.
FS	FILE SEPARATOR	A control character used to separate and qualify data logically; its specific meaning has to be specified for each application. If this character is used in hierarchical order, it delimits a data item called a file.
GS	GROUP SEPARATOR	A control character used to separate and qualify data logically; its specific meaning has to be specified for each application. If this character is used in hierarchical order, it delimits a data item called a group.
RS	RECORD SEPARATOR	A control character used to separate and qualify data logically; its specific meaning has to be specified for each application. If this character is used in hierarchical order, it delimits a data item called a record.
US	UNIT SEPARATOR	A control character used to separate and qualify data logically; its specific meaning has to be specified for each application. If this character is used in hierarchical order, it delimits a data item called a unit.

Appendix D

8142 Host Protocol

Overview

Two basic types of communication can occur between the host and the IND780com terminal:

- **Upload** – The host requests information from the IND780 terminal. The IND780 terminal responds to the request.
- **Download** – The host transmits new data to the IND780 terminal.

The IND780 commands differ from the 8142 because of the differences in functionality. The following are not supported in the IND780:

Setup Bytes (J)	Target (Setpoint) 2, 3, 4 (L)
Zero Tolerance (M)	#2 Target (Setpoint) (O)
ID (P)	

Note: 8142 commands previously referred to as Setpoint, Dribble and Preact are now listed as Target, Fine Feed and Spill, respectively, to match the commands currently used in the IND780.

Data Packet Format

All transmissions by the host or the IND780 terminal port must be in the data packet format shown:

Note: Decimal points, weight units and descriptors are not included in data fields.

Port Data Packet Format							
Data	STX	ADR	DIR	FCT	Data Field	CR	CHK
Notes	1	2	3	4	5	6	7

Table Notes:

1 <STX> ASCII Start of Text Character, Hex 02.

2 <ADR> IND780 scale address selected in setup, must be from an ASCII 2 to 9.

3 <DIR> Data Direction, "U" = Upload (IND780 to Host), "D" = Download (Host to IND780).

4 <FCT> Function code, refer to Function Code Table below.

5 <Data Field> The data field is either the uploaded data from the IND780 terminal or the downloaded data from the host. Not all function codes use the data field.

6 <CR> ASCII Carriage Return, Hex 0D.

7 <CKS> Optional Checksum Character, 2's complement of the 7 low order bits of the binary sum of all characters on a line, preceding the checksum.

Host Port Function Codes

The function code in the data packet determines what operation or data is accessed in the IND780 terminal. The codes for the various functions are listed in the Function Code Table with the valid direction of the communication (upload or download) and the length of the transmitted data field.

The IND780 terminal ignores any command it does not understand. No error detection beyond checksum is provided for downloads by the port. When critical data such as Target data is downloaded from the host to the IND780 terminal, it is recommended that the host device upload (read back) the data downloaded to the IND780 terminal to verify that the data was received correctly.

Function Code Description	Function Code		Direction	Data Field Length
	Hex	ASCII		
All Functions	41	A	U	≥ 142*
Displayed Weight	42	B	U	7**
Gross Weight	43	C	U	7**
Tare Weight	44	D	U/D	7**
Net Weight	45	E	U	7**
Time and Date	46	F	U/D	12
Next Sequential Number	47	G	U/D	6
Clear Last Printed Data from Memory	48	H	D	0
Status Bytes	49	I	U	6
Control Bytes	4B	K	D	3
Active Target	4C	L	U/D	24***
Active Target, Fine Feed, Spill, Tolerance	4E	N	U/D	24***
Last Printed Data from Printer Port	51	Q	U	*
Sub-Total Accumulator	54	T	U	10***
Total Accumulator	55	U	U	10***

* The field length is variable based on the length of the last printed data.

** The weight fields are always in the lower increment range of the current units. If the weight is in x10 expanded mode, the status bytes will reflect this and the weight fields will contain the x10 data.

*** These fields are always in the lower increment range of the primary weight units for the scale.

The most significant digit of the weight data fields will be a minus for negative weights. Weight data fields never contain decimal point but will have leading zeroes.

(A) All Functions (Upload Only)

Host Transmission					
ASCII	STX	2	U	A	CR
Hex	02	32	55	41	0D

IND780 Response					
STX	2	U	A	All Functions ≥142 Byte Data Field	CR
02	32	55	41		0D

The All Functions Data Field consists of:

Displayed Weight: (7 Bytes)

Gross Weight: (7 Bytes)

Tare Weight: (7 Bytes)

Net Weight: (7 Bytes)

Time/Date: (12 Bytes)

Next Sequential Number: (6 Bytes)

Status Bytes: (6 Bytes)

Setup Bytes (12 Filler Bytes)
(Present in All Functions Field, but not a supported feature)

Active Targets 1,2,3,4: (24 Bytes, Targets 2,3,4 are not used and always 0)

Active Target, Fine Feed, Spill, Tolerance: (24 Bytes)

Target-2, Fine Feed-2, Spill-2, Tol-2: (24 Filler Bytes, always 0)
(Present in All Functions Field, but not a supported feature)

ID: (6 Filler Bytes, always spaces) (*Present In All Functions Field, but not used*)

Last Printed Data (Length varies based on last printed data format)

(B) Displayed Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	B	CR
Hex	02	32	55	42	0D

IND780 Response					
STX	2	U	B	Displayed Weight 7 Byte Data Field	CR
02	32	55	42		0D

(C) Gross Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	C	CR
Hex	02	32	55	43	0D

IND780 Response					
STX	2	U	C	Gross Weight 7 Byte Data Field	CR
02	32	55	43		0D

(D) Tare Weight (Upload)

Host Transmission					
ASCII	STX	2	U	D	CR
Hex	02	32	55	44	0D

IND780 Response					
STX	2	U	D	Tare Weight 7 Byte Data Field	CR
02	32	55	44		0D

(D) Tare Weight (Download)

Host Transmission						
ASCII	STX	2	D	D	Tare Weight 7 Byte Data Field	CR
Hex	02	32	44	44		0D

(E) Net Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	E	CR
Hex	02	32	55	45	0D

IND780 Response					
STX	2	U	E	Net Weight 7 Byte Data Field	CR
02	32	55	45		0D

(F) Time/Date (Upload)

The time format to the IND780 terminal is fixed as 24MMSS. The date format is DDMMYY.

Host Transmission					
ASCII	STX	2	U	F	CR
Hex	02	32	55	46	0D

IND780 Response					
STX	2	U	F	Time and Date 12 Byte Data Field	CR
02	32	55	46		0D

(F) Time/Date (Download)

Host Transmission						
ASCII	STX	2	D	F	Time and Date 12 Byte Data Field	CR
Hex	02	32	44	46		0D

(G) Next Sequential Number (Upload)

Only the six least significant digits are sent using this command. The most significant digit is not available of the total 1,499,999 counter limit.

Host Transmission					
ASCII	STX	2	U	G	CR
Hex	02	32	55	47	0D

IND780 Response					
STX	2	U	G	Next Sequential Number 6 Byte Data Field	CR
02	32	55	47		0D

(G) Next Sequential Number (Download)

Host Transmission						
ASCII	STX	2	D	G	Next Sequential Number 6 Byte Data Field	CR
Hex	02	32	44	47		0D

(H) Clear Last Printed Data from Memory (Download Only)

Host Transmission					
ASCII	STX	2	D	H	CR
Hex	02	32	44	48	0D

(I) Status Bytes (Upload Only)

Host Transmission					
ASCII	STX	2	U	I	CR
Hex	02	32	55	49	0D

IND780 Response					
STX	2	U	I	Status Bytes 6 Byte Data Field	CR
02	32	55	49		0D

Bit Identification Table for Status Byte A			
Bits 0, 1 and 2			
2	1	0	Decimal Point Location
0	0	0	X.XXXXX
0	0	1	XX.XXXX
0	1	0	XXX.XXX
0	1	1	XXXX.XX
1	0	0	XXXXX.X
1	0	1	XXXXXX
1	1	0	XXXXX0
1	1	1	XXXX00
Bits 3 and 4			Build Code
4	3		
0	1		X1
1	0		X2
1	1		X5
Bit 5			Always = 1
Bit 6			Always = 0

Bit Identification Table for Status Byte B	
Status Bits	Function
Bit 0	Gross = 0, Net = 1
Bit 1	Sign, Positive = 0, Negative = 1
Bit 2	Out of Range = 1 (Over capacity or Under zero or in Setup)

Bit Identification Table for Status Byte B	
Bit 3	Motion = 1
Bit 4	lb = 0, kg = 1 (see also Status Byte C, bits 0-2)
Bit 5	Always = 1
Bit 6	Zero Not Captured At Power Up = 1

Bit Identification Table for Status Byte C			
Bits 0, 1 and 2			Weight Description
2	1	0	
0	0	0	lb or kg, selected by status byte B, bit 4
0	0	1	grams (g)
0	1	0	metric tons (t)
0	1	1	ounces (oz)
1	0	0	troy ounces (ozt)
1	0	1	penny weight (dwt)
1	1	0	tons (ton)
1	1	1	custom units
Bit 3			Print Request = 1
Bit 4			Expand Data x 10 = 1
Bit 5			Always = 1
Bit 6			Preset tare = 1

Bit Identification Table for Status Byte D							
Full Scale Increments	Bits						
	6	5	4	3	2	1	0
600	Always 1	Reserved for future use	0	0	0	0	0
1,000			0	0	0	0	1
1,200			0	0	0	1	0
1,500			0	0	0	1	1
2,000			0	0	1	0	0
2,500			0	0	1	0	1
3,000			0	0	1	1	0
4,000			0	0	1	1	1
5,000			0	1	0	0	0
6,000			0	1	0	0	1
8,000			0	1	0	1	0
10,000			0	1	0	1	1
12,000			0	1	1	0	0
15,000			0	1	1	0	1
16,000			0	1	1	1	0
20,000			0	1	1	1	1
25,000			1	0	0	0	0
30,000			1	0	0	0	1
32,000			1	0	0	1	0
35,000			1	0	0	1	1
40,000			1	0	1	0	0
45,000			1	0	1	0	1
48,000			1	0	1	1	0
50,000			1	0	1	1	1

Status Byte E Bit Definitions	
Function	Bit
Reserved: Always = 1	0
Reserved, Always = 0	1
Reserved, Always = 0	2
Reserved, Always = 0	3
Reserved, Always = 0	4
Reserved, Always = 0	5
Always = 1	6

Status Byte F Bit Definitions	
Function	Bit
Target Feeding	0
Reserved Always = 0	1
Target Fast Feeding	2
Reserved Always = 0	3
Tolerance, In Tolerance = 1	4
Reserved Always = 0	5
Always = 1	6

(K) Control Bytes (Download Only)

Only 1 control byte function can be used at a time. If more than 1 control byte function is desired, then repeat the control byte function once for each function desired.

Control bytes A and B are used to control the display. Control byte C is used to clear subtotal and total accumulators.

Host Transmission								
ASCII	STX	2	D	K	CBA	CBB	CBC	CR
Hex	02	32	44	4B				0D

Control Byte A (CBA) Bit Definition Control Byte B (CBB) Bit Definition				
Function	Bit		Function	Bit
Print Request = 1	0		Reserved Always = 0	0
Switch to primary units = 1	1		Reserved Always = 0	1
Switch to second units = 1	2		Reserved Always = 0	2
Clear Tare = 1	3		Reserved Always = 0	3
Autotare = 1	4		Reserved Always = 0	4
Zero = 1	5		Blank Display = 1 Restore = 0	5
Always a 1	6		Always = 1	6

Control Byte C (CBC) Bit Definition	
Function	Bit
Clear Subtotal Accumulator = 1	0
Clear Total Accumulator = 1	1
Reserved Always = 0	2
Reserved Always = 0	3
Reserved Always = 0	4
Reserved Always = 0	5
Always = 1	6

(L) Active Target (Upload)

Target value is six numeric digits with no decimal point, just first 6 byte is used for Target, others bytes is always 0. This value is in the lower increment range of the primary weight units for the scale.

Host Transmission					
ASCII	STX	2	U	L	CR
Hex	02	32	55	4C	0D

IND780 Response					
STX	2	U	L	Active Target 24 Byte Field	CR
02	32	55	4C		0D

(L) Active Target (Download)

Host Transmission						
ASCII	STX	2	D	L	Active Target 24 Byte Field	CR
Hex	02	32	44	4C		0D

(N) Active Target, Fine Feed, Spill, Weight Tolerance (Upload)

Target, Fine Feed, Spill and tolerance values must be downloaded even if only one value is changed. Each value is six digits without decimal point.

Host Transmission					
ASCII	STX	2	U	N	CR
Hex	02	32	55	4E	0D

IND780 Response					
STX	2	U	N	Target, Fine Feed, Spill, Tolerance. 24 Byte Field	CR
02	32	55	4E		0D

(N) Active Target, Fine Feed, Spill, Weight Tolerance (Download)

Host Transmission						
ASCII	STX	2	D	N	Target, Fine Feed, Spill, Tolerance. 24 Byte Field	CR
Hex	02	32	44	4E		0D

(Q) Last Printed Data (Upload Only)

This function code will return the last printed data in the format specified by the print output templates. If the data needs to match the default 8142 format of 45 bytes, then an output template should be created to emulate the 8142 format. The 8142 format is shown below.

Host Transmission					
ASCII	STX	2	U	Q	CR
Hex	02	32	55	51	0D

IND780 Response						
ASCII	STX	2	U	Q	Data Byte per template format	CR
Hex	02	32	55	51		0D

Default for the 8142 print format.

Data Length	
Gross Weight	7
Tare Weight	7
Net Weight	7
Time	6
Date	6
CN	6
Spaces	6

(T) Subtotal Accumulator (Upload Only)

Host Transmission					
ASCII	STX	2	U	T	CR
Hex	02	32	55	54	0D

IND780 Response					
STX	2	U	T	Subtotal Accumulator 10 Byte Data Field	CR
02	32	55	54		0D

(U) Total Accumulator (Upload Only)

Host Transmission					
ASCII	STX	2	U	U	CR
Hex	02	32	55	55	0D

IND780 Response					
STX	2	U	U	Total Accumulator 10 Byte Data Field	CR
02	32	55	55		0D

Appendix E

8530 Host Protocol

Overview

The data format used by the IND780 protocol is either a 10 or 11 bit ASCII frame which consists of:

- 1 start bit
- 7 or 8 data bits
- 1 selectable parity bit
- 1 stop bit

A selectable checksum character is provided to ensure the integrity of the data.

There are 2 basic types of communication that occur between the host and the IND780 terminal:

Upload—The host requests information from the IND780 terminal. The IND780 terminal responds to the request.

Download—The host transmits new data to the IND780 terminal.

The IND780 commands differ from the 8530 because of the differences in functionality. The following are **not** supported in the IND780:

- Setup Bytes (J)
- Target (Setpoint) 2 (M)
- Target (Setpoint) 3 (N)
- Target (Setpoint) 4 (O)
- ID (P)

Another difference is that the 8530 only supported lb or kg, while the IND780 supports many units, so the units indication / selection are primary and secondary.

Note: All 8530 commands previously referred to as Setpoint will now be listed at Target. Target is the terminology currently used in the IND780.

Data Packet Format

All transmissions by the host or the IND780 terminal are in the format shown below.

Data	STX	ADR	DIR	FCT	Data Field	CR	CHK
Notes	A	B	C	D	E	F	G

Table Notes:

A <STX> ASCII Start of Text Character, Hex 02.

B <ADR> IND780 scale address selected in setup, must be from an ASCII 2 to 9.

C <DIR> Data Direction, "U" = Upload (IND780 to Host), "D" = Download (Host to IND780)

D <FCT> Function code, refer to Function Code Table below.

E <Data Field> The data field is either the uploaded data from the IND780 or the downloaded data from the host. Not all function codes use the data field.

F <CR> ASCII Carriage Return, Hex 0D

G <CKS> Optional Checksum Character, 2's complement of the 7 low order bits of the binary sum of all characters on a line, preceding the checksum.

Host Interface Message Format

Host Port Function Codes

No error detection beyond checksum is provided for downloads. The IND780 terminal ignores any command it does not understand. When critical data such as Target data is downloaded from the host to the IND780 terminal, it is recommended that the host device upload (read back) the data downloaded to the IND780 terminal to verify that the data was received correctly.

Function Code Description	Function Code		Direction	Data Field Length
	Hex	ASCII		
Read All Functions	41	A	U	116
Displayed Weight	42	B	U	8 *
Gross Weight	43	C	U	8 *
Tare Weight	44	D	U/D	8 *
Net Weight	45	E	U	8 *
Time and Date	46	F	U/D	12
Next Sequential Number	47	G	U/D	6
Status Bytes	49	I	U	2
Control Bytes	4B	K	D	2
Active Target	4C	L	U/D	7 **
Subtotal Accumulator	51	Q	U	11 **
Total Accumulator	52	R	U	11 **

* The weight fields are always in the current units. If the weight is in x10 expanded mode, the status bytes will reflect this and the weight fields will contain the x10 data.

** These fields are always in the primary weight units for the scale.

(A) Read All Functions (Upload Only)

Host Transmission					
ASCII	STX	2	U	A	CR
Hex	02	32	55	41	0D

IND780 Response					
STX	2	U	A	All Functions 116 Byte Data Field	CR
02	32	55	41		0D

Weight data fields will include decimal point, leading zeroes and sign character if necessary.

The All Functions Data Field Consists of:

Displayed Weight: (8 Bytes)

Gross Weight: (8 Bytes)

Tare Weight: (8 Bytes)

Net Weight: (8 Bytes)

Time/Date: (12 Bytes)

Next Sequential Number: (6 Bytes)

Status Bytes: (2 Bytes)

Setup Bytes (2 Bytes)
(Present in All Functions Field Always = 0, but not a supported feature)

Active Target: (28 Bytes, first 7 bytes are used for Target, others are always 0)

ID: (12 Filler bytes, always spaces)
(Present in All Functions Field, but not a supported feature)

Subtotal Accumulator: (11 Bytes)

Total Accumulator: (11 Bytes)

(B) Displayed Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	B	CR
Hex	02	32	55	42	0D

IND780 Response					
STX	2	U	B	Displayed Weight 8 Byte Data Field	CR
02	32	55	42		0D

(C) Gross Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	C	CR

Host Transmission					
Hex	02	32	55	43	0D

IND780 Response					
STX	2	U	C	Gross Weight 8 Byte Data Field	CR
02	32	55	43		0D

(D) Tare Weight (Upload)

Host Transmission					
ASCII	STX	2	U	D	CR
Hex	02	32	55	44	0D

IND780 Response					
STX	2	U	D	Tare Weight 8 Byte Data Field	CR
02	32	55	44		0D

(D) Tare Weight (Download)

Downloaded tare weight value must match the displayed increment type and size programmed into the IND780 terminal or else the downloaded value is ignored.

Host Transmission						
ASCII	STX	2	D	D	Tare Weight 8 Byte Data Field	CR
Hex	02	32	44	44		0D

(E) Net Weight (Upload Only)

Host Transmission					
ASCII	STX	2	U	E	CR
Hex	02	32	55	45	0D

IND780 Response					
STX	2	U	E	Net Weight 8 Byte Data Field	CR
02	32	55	45		0D

(F) Time/Date (Upload)

Host Mode time and date format is [24MMSSDDMMYY] 24 = hours, MM = minutes, SS = seconds, DD = day, MM = month and YY = year.

Host Transmission					
ASCII	STX	2	U	F	CR
Hex	02	32	55	46	0D

IND780 Response					
STX	2	U	F	Time and Date	CR

IND780 Response					
02	32	55	46	12 Byte Data Field	0D

(F) Time/Date (Download)

Host Transmission						
ASCII	STX	2	D	F	Time and Date 12 Byte Data Field	CR
Hex	02	32	44	46		0D

(G) Next Sequential Number (Upload)

Host Transmission					
ASCII	STX	2	U	G	CR
Hex	02	32	55	47	0D

IND780 Response					
STX	2	U	G	Next Sequential Number 6 Byte Data Field	CR
02	32	55	47		0D

(G) Next Sequential Number (Download)

Host Transmission						
ASCII	STX	2	D	G	Next Sequential Number 6 Byte Data Field	CR
Hex	02	32	44	47		0D

Note: Host command function code **H** (hex value 48) is not used with the 8530 host interface.

(I) Status Bytes (Upload Only)

Status bytes 1 and 2 provide information about the operation of the IND780 terminal.

Host Transmission					
ASCII	STX	2	U	I	CR
Hex	02	32	55	49	0D

IND780 Response						
STX	2	U	I	SB1	SB2	CR
02	32	55	49			0D

Status Byte 1 Bit Definition	
Function	Bit
Gross = 0, Net = 1	0
Positive = 0, Negative = 1	1

Status Byte 2 Bit Definition	
Function	Bit
Target Feeding = 1	0
Reserved, always = 0	1

Status Byte 1 Bit Definition			Status Byte 2 Bit Definition	
Out of Range = 1 (Over capacity or Under Zero)	2		Reserved, always = 0	2
Motion = 1	3		Reserved, always = 0	3
Primary = 0 Secondary =1	4		Print Request = 1	4
Power Up Zero Not Captured = 1	5		Expanded Weight Display = 1	5
Always = 1	6		Always a 1	6

(K) Control Bytes (Download Only)

Only one control byte function can be used at a time. If more than 1 control byte function is desired then repeat the control byte function once for each function desired.

Host Transmission							
ASCII	STX	2	D	K	CBA	CBB	CR
Hex	02	32	44	4B			0D

Control Byte A Bit Definition	
Function	Bit
Print Request = 1	0
Switch to Primary Unit = 1	1
Switch to Second Unit= 1	2
Clear Tare = 1	3
Auto Tare = 1	4
Zero = 1	5
Always = 1	6

Control Byte B Bit Definition	
Function	Bit
Clear Accumulators = 1	0
Reserved, always = 0	1
Reserved, always = 0	2
Reserved, always = 0	3
Reserved, always = 0	4
Reserved, always = 0	5
Always = 1	6

(L) Active Target (Upload)

The Target value for the scale's Active Target is accessed individually by function code "L" (hex 4C). Targets 2-4 and function codes "M", "N" and "O" (hex values 4D, 4E and 4F) are not supported.

Host Transmission					
ASCII	STX	2	U	L	CR
Hex	02	32	55	4C	0D

IND780 Response					
STX	2	U	L	Target 7 Byte Data Field	CR
02	32	55	4C		0D

(L) Active Target (Download)

The Downloaded Target value must match the primary weight units and increment size programmed into the IND780 terminal, or the value will be ignored. It is

strongly recommended that you upload the Target data after a download to verify that the IND780 terminal has accepted the Target value.

Host Transmission						
ASCII	STX	2	D	L	Target 7 Byte Data Field	CR
Hex	02	32	44	4C		0D

(Q) Subtotal Accumulator (Upload Only)

Host Transmission					
ASCII	STX	2	U	Q	CR
Hex	02	32	55	51	0D

IND780 Response					
STX	2	U	Q	Subtotal Accumulator 11 Byte Data Field	CR
02	32	55	51		0D

(R) Total Accumulator (Upload Only)

Host Transmission					
ASCII	STX	2	U	R	CR
Hex	02	32	55	52	0D

IND780 Response					
STX	2	U	R	Total Accumulator 11 Byte Data Field	CR
02	32	55	52		0D

Appendix F

PT6S3 Protocol

The PT6S3 protocol includes the commands of its predecessors, notably PT6S2, the most common, in order to maintain full compatibility of the functions. This protocol allows the replacement of an old model indicator in an existing installation. This installation interrogates uniquely with upper-case letters commands. New functions are obtained from commands with lower-case letters.

Overview

The "slave" indicator recognizes certain single ASCII character commands transmitted by the "master" terminal (computer or automaton). This protocol therefore contains all of the functions of PT6S2 necessary for an indicator with a single measuring channel. The functions related to the commands issued by a master terminal are shown in Table F-1.

Table F-1: Functions Related to the Commands Issued by a Master Terminal

P	Request for the value of the weight displayed on the indicator
M	Request for zeroing the weight indicator
T	Request for semi-automatic taring with weighing in net or return to gross weighing if the tare is already activated.
R	Request for return to gross weighing and clear tare

The new commands specific to PT6S3 are shown in Table F-2:

Table F-2: New Commands Specific to PT6S3

p -	Request to read the weight displayed on the indicator; no print command is issued
m -	Request to zero the main display of the indicator
t -	Request for semi-automatic tare with weighing in net mode, or to return to gross weighing if tare already activated
n -	Request to enter net mode
r -	Request to enter gross mode and clear tare
g -	Read metrological parameters
z -	Read minimum weighing capacity
w -	Read maximum weighing capacity
q -	Request for simultaneous read of displayed weight and transaction number (5 digits) for indicator with printer (with DTR management); a demand print command is also issued

Principle of Operation

The character frame, represented below, is the basis for the simple and extended response format to the PT6S2 and PT6S3 host commands.

P1		Body of the response		P2		CKS		P3

The following characters are used by the IND780 terminal:

P1 = CR (013 Dec)

P2 = 000 (not used by the IND780)

P3 = 000 (not used by the IND780)

Zero values for P2 and P3 are not transmitted; therefore, in this case the format is similar to the PT6S2 format.

The weight data is always sent by the terminal in the lower increment range of the current displayed weight units with leading zeroes and no decimal point.

Characteristics of the Simple Format (PT6S2 Style)

The frame is represented in Figure A-1.

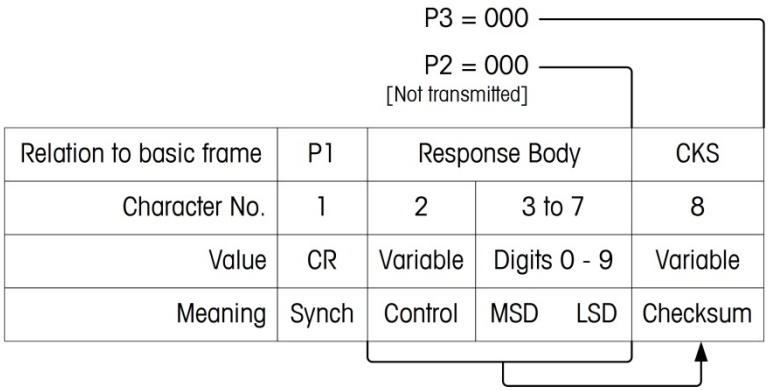

Figure F-1: Character Frame

The checksum is obtained by binary addition without carryover of Characters No 2 to 7. If the calculated checksum character value is less than 20 Hex, then 20 Hex is added to it.

The control character (No 2) can contain the information shown in Table F-3.

Table F-3: Control Character (No 2) Information

I	Value of the weight stable
SPC (space)	Value of the weight not stable
D	Weight value is below zero
S	Gross weight above "blank over capacity" limit
*	Request from the master has been executed
#	Request from the master cannot be executed. Characters No 3 to 7 contain the displayed weight, stable or not

Response to an Upper–Case Letter Command

Table F-4 shows the P, M, T, R commands defined previously. The body of the response made up of the 5 characters No 3 to 7 is shown, with character 7 giving the least significant digit.

Table F-4: P, M, T, R Commands

P	5 digits of the displayed weight of the indicator (GROSS or NET)
M	5 digits at 0 if the setting to 0 was executed. 5 digits of the weight if the command was not executed.
T	5 digits of the weight after the request was executed (0 or gross weight). 5 digits of the weight if the command was not executed.
R	5 digits of the GROSS weight.

- Functions M and T can be executed only if stability is effective at the time of the request. If not, an answer with a "#" control character is made.

Response to a Lower-Case Letter Command

Some of the commands using lower-case letters, such as p, m, t, r, are identical to those made in upper-case letters. When using a lower-case letter the:

Response is obtained in the same format.

Control character takes one of the information items defined for PT6S3.

The checksum is different because it is calculated by taking into account character No 1 (013 Dec).

Characteristics of the Extended Format

Response Frame

The various commands supported are defined previously. Two types of responses are given, depending on their size.

Commands p, m, t, r, n, g, z and w give responses with the same size (six-character response body). In this case, the frame layout is as shown in Figure F-2.

Char. No	1	2	3	4	5	6	7	8
Value	P1	Variable	0 to 9	0 to 9	0 to 9	0 to 9	0 to 9	Variable
Meaning	Synch	Control	most significant				least significant	Checksum

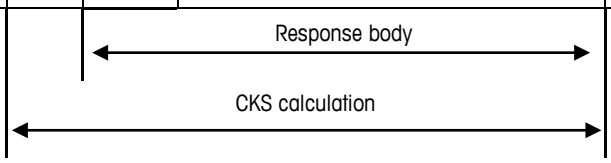

Figure F-2: Frame Layout

The "q" command generates a response with a bigger size.

The response body is increased by five digits for the ticket transaction number, and a separating space.

The frame is composed as shown in Figure F-3.

Char. No	1	2	3 to 7	8	9 to 13	14
Value	P1	Variable	0 to 9	SP	0 to 9	Variable
Meaning	Synch	Control	most least significant		Ticket No Most sig. Least sig.	Checksum

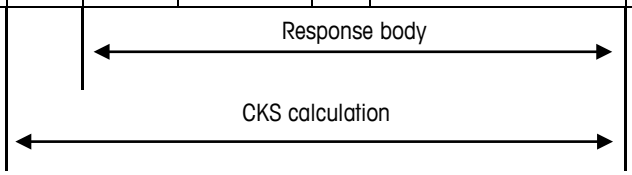

Figure F-3: Frame Composition

Calculation of the Checksum Character (CKS)

To calculate the checksum character, the following operations are performed successively:

1. Binary sum, without carryover, of all the characters composing P1 + Response body.
2. Comparison of this result to 20 (hex) by applying a 7f mask.
3. If the result is lower than 20 (hex), 20 (hex) is added to it.

This last result is the checksum It is therefore always comprised between 20 (hex) and 7f (hex) (Printable character).

Indication of Control Character

Indication of the control character and specific contents of the response body for each of the "lower-case" commands is as follows:

p – Request to read the weight displayed on the main indicator (No demand print command is issued)

Response—Character No 3 to 7—five digits of the displayed weight (gross or net)

Character No 2 (Control)

- "I" if gross positive stable
- "i" if gross negative stable
- " " if gross positive not stable
- "-" if gross negative not stable
- "N" if net positive stable
- "n" if net negative stable
- "B" if net positive not stable
- "b" if net negative not stable
- "D" if indicator in under zero blanking
- "S" if indicator in overload
- "Z" if indicator on metrological zero, unstable
- "z" if indicator on metrological zero, stable

m – Request to zero the indicator's display

Condition: Weight stable and comprised in the configured zero range around the initial zero.

Response: Command executed = Characters No 3 to 7 all at 0.

Command not executed = Characters No 3 to 7 are at the gross or net displayed weight in the current measuring units.

Character No 2 (Control)

- "m" if command executed
- "#" if command not executed (instability, out of range, …)

t – Request for semi-automatic taring with weighing in net, or return to weighing in gross if the tare is already activated (toggle)

Condition: Stable weight

Response: The control character contains:

- "t" if the request was executed. (Characters No 3 to 7 represent the weight displayed after the request: 0 or gross weight)
- "#" if taring cannot be executed. (instability, out of range, etc. Characters No 3 to 7 represent the gross weight, within the measuring range)

n – Request to enter net mode (taring), (non-toggle, unidirectional)

Condition: Stable weight

Response: The control character contains:

"n" if the response was executed. (Characters no 3 to 7 are at 0).

"#" if not executed. (instability, out of range, etc. Characters No 3 to 7 represent the unsigned gross in the measuring range).

- For functions "m", "t", and "n" to be executed, stability must be effective at the time of the request. If stability is not set, the slave answers with #.

r – Request for gross-mode weighing and clear tare

Response: The control character contains:

"r" if the request is executed. (Characters No 3 to 7 contain the gross weight).

"#" if the request cannot be executed. (The contents of characters No 3 to 7 is not significant.)

- Commands "n" and "r" are complementary. With command "t", they permit all the possibilities of semi-automatic taring and of return to gross weigh mode.

g – Read metrological parameters

Response:

Character No	2	3	4	5	6	7
Symbol	C.C.	Spc	V	U	P	Z

C.C.: Control character with the value:

"g" if request is accepted

"#" if request cannot be executed

Spc: defines a space (ASCII code 20 Hex)

V: Number of displayed digits before the decimal point (including non significant zero)

U: Weight measurement unit, with the values:

"l" for pounds (lb)

"t" for metric tons (t)

"k" for kilogram (kg)

"g" for grams (g)

"o" for ounces

"n" for tons (ton)

"c" for custom units

P: Weight unit step, value 1, 2 or 5

Z: Number of fixed zeros, with value 0 or 1.

z – Read minimum weighing capacity

Response: The control character contains:

"z" if the reading was made. (Characters No 3 to 7 represent the minimum weighing capacity)

"#" if the reading is impossible (Characters No 3 to 7 are not significant)

w – Read maximum weighing capacity

Response: The control character contains:

"w" if the request is executed. (Characters no 3 to 7 return the value of the weighing capacity recorded in the memories of the measurer).

"#" if the reading cannot be executed. (In this case characters no 3 to 7 are not significant).

- All lower-case commands above are common to the measurers of the series TX30……TX40. The "q" command described hereafter does not apply to the TX30 measurer, only to those that have several simultaneous links.

q – Request for simultaneous reading of displayed weight and the five-digit transaction number (also issues a Demand print command)

Master's command: q

The response body was described in Characteristics of the Extended Format, the Response Frame section.

Necessary condition: Weight stable within the measuring range.

The control character (No 2) takes the following forms:

- All of the forms obtained in response to command "p" (see p – Request for reading the weight displayed on the main indicator) if the request is executed.
- "!" in case of printer fault

  In this latter case, the value returned for the weight is null. The transaction number is not incremented (it keeps the last value taken).

- The transaction number increments by one unit at each valid response of the "q" function. The transaction number is never reset to zero.

Response to an Upper-Case Letter Command

In this case the response is forced into the PT6S2 simplified format and:

- Frame is given with P1 = CR (013)

- Control character also takes simplified forms
- Checksum also is simple

Response to an Unknown Command

Where P1 = CR

The response will be made in the PT6S2 format as follows, irrespective of the (lower or upper) case of the unknown command letter.

Character No	1	2	3	4	5	6	7	8
	CR 013	?	0	0	0	0	0	<
								CKS

Response to an Invalid Command

A response is sent for each request. If the response is not valid, another request must be made. This protocol avoids blocking the data processing system dialog.

Appendix G

SMA Protocol

Overview

The Scale Manufacturers Association (SMA) protocol is a standard serial communications protocol based on a "Master/Slave" or "Command/Response" architecture. The host device (PC or PLC) is always the commanding device and the scale never sends an unsolicited response.

The SMA protocol uses a simple command set based on a single ASCII character sent by the host device to the scale instrument. In turn the scale sends the required response back to the host. In reference to the SMA Scale Serial Communication Protocol document SMA SCP-0499 (rev 1, November 2005), Level #1 and Level #2 command sets have been defined. Level #1 addresses the functionalities present in a basic scale terminal, while Level #2 covers the more powerful features of an advanced terminal.

The SMA protocol is mostly intended for use in developing host communications with a single scale. Multi-scale terminals like the IND780 will require separate communication ports to provide access to the individual scales.

Data Packet Format

Most transmissions by the host are in the standard format shown below.

Data	LF	FCT	Data Field	CR
Notes	A	B	C	D

Table Notes:

A <LF> ASCII Line Feed Character, Hex 0A used to start the data frame.

B <FCT> Function code, refer to Function Code Table below.

C <Data Field> The data field is the downloaded data from the host. Not all function codes use or include the data field.

D <CR> ASCII Carriage Return, Hex 0D used to end the data frame.

There is an Abort Command <ESC> that does not follow the standard format described above. It does not require the <LF> and <CR> characters.

Transmissions by the IND780 in response to most of the host commands are in the format shown below, with the exception of commands "D", "A", "B", "I" and "N" which have specific data definitions.

Data	LF	SB	RB	NB	MB	FB	Data Field	Units	CR
Notes	A	B	C	D	E	F	G	H	I

Table Notes:

A <LF> ASCII Line Feed Character, Hex 0A used to start the data frame.

B <SB> Scale status byte. See description below.

C <RB> Weighing range byte. ("1" = first range, "2" = second range, "3" = third range, etc.).

D <NB> Gross/net status byte. See description below.

E <MB> Motion status byte. "M" (Hex 4D) indicates scale in motion and "Space" (Hex 20) indicates scale not in motion.

F <FB> Reserved for future use. Always a "Space" (Hex 20).

G <Data Field> The data field is the uploaded weight data from the IND780 terminal. This is a fixed ten characters field with leading spaces, a decimal point (if present) and a minus sign for negative weight values.

H <Units> This is a fixed three characters field with trailing spaces to indicate the units of measure. See description below.

I <CR> ASCII Carriage Return, Hex 0D used to end the data frame.

Response—Character <SB> (scale status byte):

"Z" Center of zero
"O" Over capacity
"U" Under capacity blanking
"E" Zero attempt failed error
"I" Power up initial zero error
"T" Taring attempt failed error
" " None of the above conditions exist

- For "E", "I" and "T" error conditions, the <Data Field> weight information is sent as dashes (----------).

Response—Character <NB> (gross/net weight status byte):

"G" Gross weight
"T" Tare weight (in response to "M" command)
"N" Net weight
"g" Gross weight in x10 mode (in response to "H", "Q" or "S" command)
"n" Net weight in x10 mode (in response to "H", "Q" or "S" command)

Response—Characters <Units> (units of measurement):

"lb_" Pounds
"kg_" Kilograms
"g__" Grams
"t__" Metric tons
"ton" Tons

"ozt" Troy ounces

"dwt" Pennyweights

"oz_" Ounces

- For custom units, the user can configure up to 3 characters that is transmitted in the <Units> field.

Host Interface Message Format

Host Command Function Codes

The function code in the host command data packet determines what operation or data is accessed in the IND780 terminal. The Level #1 and Level #2 commands for the various functions supported by the IND780 terminal are listed in the Function Code Table (see Table G-1).

For these explicit commands issued by the host, there is always an expected response from the terminal within a certain period, with the exception of the <ESC> command. This provides some level of error handling for the host device. Furthermore the IND780 terminal also provides responses to unrecognized commands or data format.

Table G-1: Function Code Table

Function Code Description	Level	Function Code	
		Hex	ASCII
Request Displayed Weight	1	57	W
Request High Resolution (x10) Weight	2	48	H
Request Displayed Weight After Stability	2	50	P
Request High Resolution Weight After Stability	2	51	Q
Request To Zero Scale	1	5A	Z
Request To Tare Or Preset Tare Scale	2	54	T
Return Tare Weight	2	4D	M
Clear Scale Tare Weight	2	43	C
Change Units Of Measure	2	55	U
Invoke Scale Diagnostics	1	44	D
About Scale Data (First line)	1	41	A
About Scale Data (Scroll)	1	42	B
Scale Information (First line)	2	49	I
Scale Information (Scroll)	2	4E	N
Abort Command	1	1B	ESC
Repeat Displayed Weight Continuously	2	52	R
Repeat High Resolution Weight Continuously	2	53	S

(W) Request Displayed Weight

Host Transmission			
ASCII	LF	W	CR
Hex	0A	57	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units.

(H) Request High Resolution Weight

Host Transmission			
ASCII	LF	H	CR
Hex	0A	48	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	X10 Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight in high resolution (x10) with the corresponding units. The gross/net status byte <NB> will be indicated by "g" (67 Hex) or "n" (6E Hex).

(P) Request Displayed Weight After Stability

Host Transmission			
ASCII	LF	P	CR
Hex	0A	50	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the stable displayed weight with the corresponding units. Since this command requests a stable weight, there may be a significant delay before the response is returned, so it is the host's responsibility to handle the timeout error.

(Q) Request High Resolution Weight After Stability

Host Transmission			
ASCII	LF	Q	CR
Hex	0A	51	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	X10 Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the stable displayed weight in high resolution (x10) with the corresponding units. The gross/net status byte <NB> will be indicated by "g" (67 Hex) or "n" (6E Hex). Since this command requests a stable weight, there may be a significant delay before the response is returned, so it is the host's responsibility to handle the timeout error.

(Z) Request To Zero Scale

Host Transmission			
ASCII	LF	Z	CR
Hex	0A	5A	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units. This function relies on the stability of the scale to perform the requested operation successfully. If the zero operation is successful a response is immediately returned.

If the conditions do not allow the operation to execute successfully after a certain timeout period, an error response is also returned. The scale status byte <SB> will represent a zero attempt success with a "Z" (5A Hex) and an "E" (45 Hex) if it fails. The weight data response field is represented by dashes if the attempt to zero fails.

(T) Request To Tare Scale

Host Transmission			
ASCII	LF	T	CR
Hex	0A	54	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units. This function relies on the stability of the scale to perform the requested operation successfully. If the tare operation is successful, a response is immediately returned with <SB> being indicated with a " " (20 Hex) and <NB> being indicated with an "N" (4E Hex).

If the conditions do not allow the operation to execute successfully after a certain timeout period, an error response is also returned with <SB> = "T" (54 Hex). The weight data response field is represented by dashes if the attempt to tare fails.

(T) Preset Tare Scale

Host Transmission				
ASCII	LF	T	Tare Weight 10 Bytes Data Field	CR
Hex	0A	54		0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

This function allows for a preset tare value to be downloaded to the terminal. The downloaded value should match the current displayed units and increment size with leading spaces and a decimal point (if present).

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units. If the preset tare operation is successful, a response is immediately returned with <SB> being indicated with a " " (20 Hex) and <NB> being indicated with an "N" (4E Hex).

If the conditions do not allow the operation to execute successfully, an error response is also returned with <SB> = "T" (54 Hex). The weight data response field is represented by dashes if the attempt to preset a tare value fails.

(M) Return Tare Weight

Host Transmission			
ASCII	LF	M	CR
Hex	0A	4D	0D

IND780 Response								
LF	SB	RB	T	MB	SP	Tare Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A			54		20			0D

The terminal will respond with the scale status, weighing range, gross/net status, motion status and the current tare weight with the corresponding units. The <NB> status byte is indicated with a "T" (54 Hex).

(C) Clear Scale Tare Weight

Host Transmission			
ASCII	LF	C	CR
Hex	0A	43	0D

IND780 Response								
LF	SB	RB	G	MB	SP	Gross Weight	Units	CR

IND780 Response								
0A			47		20	10 Bytes Data Field	3 Bytes	0D

This function allows the host to clear the tare weight and return the scale to gross weighing mode. The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed gross weight with the corresponding units. The <NB> status byte is indicated with a "G" (47 Hex).

(U) Change Units Of Measure

Host Transmission			
ASCII	LF	U	CR
Hex	0A	55	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

This function triggers the scale to switch between the primary and secondary units of measure. The terminal will respond with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units.

(D) Invoke Scale Diagnostics

Host Transmission			
ASCII	LF	D	CR
Hex	0A	44	0D

IND780 Response					
LF	DB 1	DB 2	DB 3	DB 4	CR
0A					0D

This function triggers a test on the internal BRAM and EEPROM memory, as well as a check on the state of the scale calibration based on the results of the last calibration test. After completion of the check, the terminal will respond with the BRAM, EEPROM and calibration status.

Response—Character <DB1> (diagnostic byte 1):

"R" = BRAM error or " " = no error.

Response—Character <DB2> (diagnostic byte 2):

"E" = EEPROM error or " " = no error.

Response—Character <DB3> (diagnostic byte 3):

"C" = Calibration error or " " = no error

Response—Character <DB4> (diagnostic byte 4): Reserved. Always a " ".

(A) About Scale Data (First Line)

Host Transmission			
ASCII	LF	A	CR
Hex	0A	41	0D

IND780 Response						
LF	S	M	A	:	About Data Field	CR
0A	53	4D	41	3A	Variable, 25 Bytes Max	0D

The terminal will respond with the first line of system data about the terminal and scale. The About data field indicates the SMA compliance level and revision. The level information is separated from the revision by a "/" (2F Hex) character.

(B) About Scale Data (Scroll)

Host Transmission			
ASCII	LF	B	CR
Hex	0A	42	0D

IND780 Response				
LF	Title Field 3 Bytes	:	About Data Field	CR
0A		3A	Variable, 25 Bytes Max	0D

With each "B" command sent, the terminal will respond with the next line of system data about the terminal and scale. Information on the manufacturer, model, firmware revision and serial number are each provided successively in individual responses. The title field (fixed 3 characters, left justified with trailing spaces) indicates which data is currently being read by the host.

Response—Title Field:

"MFG" Manufacturer (first response to "B" command).

"MOD" Product model (response to 2nd "B" command).

"REV" Product firmware revision (response to 3rd "B" command).

"SN_" Product serial number (response to 4th "B" command). The About data field is only included if a serial number is made available.

"END" Last line of response to the "B" command. The About data field is not included in the "END" response.

Example:

1st Command = "B" Response = "MFG:Mettler-Toledo, Inc."

2nd Command = "B" Response = "MOD:IND780"

3rd Command = "B" Response = "REV:5.1.06 * 03/05/2008"

4th Command = "B" Response = "SN :1234"

5th Command = "B" Response = "END:"

- If additional "B" commands are issued after the last line of response, the terminal will respond with a <LF>?<CR>. The "A" command will reset the response to the "B" command back to the first line.

(I) Scale information (First Line)

Host Transmission			
ASCII	LF	I	CR
Hex	0A	49	0D

IND780 Response						
LF	S	M	A	:	Info Data Field	CR
0A	53	4D	41	3A	Variable, 25 Bytes Max	0D

The terminal will respond with the first line of metrology information about the scale. The Info data field indicates the SMA compliance level and revision. The level information is separated from the revision by a "/" (2F Hex) character.

(N) Scale information (Scroll)

Host Transmission			
ASCII	LF	N	CR
Hex	0A	4E	0D

IND780 Response				
LF	Title Field 3 Bytes	:	Info Data Field	CR
0A		3A	Variable, 25 Bytes Max	0D

With each "N" command sent, the terminal will respond with the next line of metrology information about the scale. Information on the scale type, capacity/increment, capacity/increment for other available weighing ranges and the list of SMA-supported commands are each provided successively in individual responses. The title field (fixed 3 characters, left justified with trailing spaces) indicates which data is currently being read by the host.

Response—Title Field:

"TYP" Scale type (First response to "N" command where the Info data field = "S" for scale).

"CAP" Capacity/increment (Response to 2nd or subsequent "N" commands depending on the number of weighing ranges programmed. The Info data field format being "uuu:c..c:n:d" where uuu = units, c..c = capacity, n = increment size and d = decimal point position).

"CMD" SMA supported commands excluding Level #1, "I" and "N" commands (Response to subsequent "N" command).

"END" Last line of response to the "N" command. The Info data field is not included in the "END" response.

Example (for a single range scale with a capacity/increment of 500 kg x 0.1 kg):

1st Command = "N" Response = "TYP:S"

2nd Command = "N" Response = "CAP:kg :500:1:1"

3rd Command = "N" Response = "CMD:HPQRSTMCU"

4th Command = "N" Response = "END:"

- If additional "N" commands are issued after the last line of response, the terminal will respond with a <LF>?<CR>. The "I" command will reset the response to the "N" command back to the first line.

(ESC) Abort Command

Host Transmission	
ASCII	ESC
Hex	1B

This command does not require the <LF> and <CR> characters to be transmitted and there is also no return response from the scale terminal. This function aborts any pending response expected from the scale terminal and acts like a reset, to free up the communications for the next host command.

(R) Repeat Displayed Weight Continuously

Host Transmission			
ASCII	LF	R	CR
Hex	0A	52	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	Displayed Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond continuously with the scale status, weighing range, gross/net status, motion status and the displayed weight with the corresponding units. The <ESC> command or another single response command can be used to stop this continuous response.

(S) Repeat High Resolution Weight Continuously

Host Transmission			
ASCII	LF	S	CR
Hex	0A	53	0D

IND780 Response								
LF	SB	RB	NB	MB	SP	X10 Weight 10 Bytes Data Field	Units 3 Bytes	CR
0A					20			0D

The terminal will respond continuously with the scale status, weighing range, gross/net status, motion status and the displayed weight in high resolution (x10) with the corresponding units. The gross/net status byte <NB> will be indicated by

"g" (67 Hex) or "n" (6E Hex). The <ESC> command or another single response command can be used to stop this continuous response.

Unrecognized Command Response

IND780 Response			
ASCII	LF	?	CR
Hex	0A	3F	0D

Any host command that the terminal does not support or recognize as valid will be responded to by the terminal with a "?" character.

Communication Error Response

IND780 Response			
ASCII	LF	!	CR
Hex	0A	21	0D

Any host command that the terminal does not recognize because of a communication error as a result of a parity or data framing mismatch will generate a terminal response with a "!" character.

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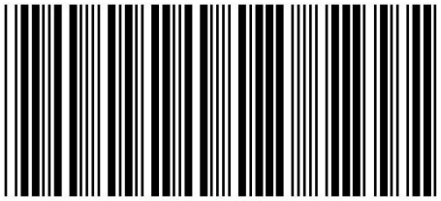

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