Chapter 8 Communications

8.1 Communication Protocol Parameter Setup

P200.XX Baud

This parameter determines the baud rate that will be used by the Print and Comm Ports. The baud rate specifies the rate at which characters are transmitted and received in terms of bits per second. The selections range from 150 to 19,200 baud.

NOTE:
Since P200 to P208 establish the communications protocol for the COMM Port. Make sure that all peripheral devices which you connect to the indicator are set to the same selected baud rate.

P201.XX #data

This parameter will set the number of data bits for the transmission to either 7 or 8 (if 7 bits is selected, then extended ASCII codes, those greater than decimal 127, will not be transmitted from the indicator).

P202.XX Par'y

This parameter sets the parity of the transmission to none, even or odd.

P203.XX #stop

This parameter sets the number of stop bits to 1 or 2. The number of stop bits has an affect only on outgoing transmissions. As long as incoming transmissions have at least 1 stop bit, the indicator will correctly receive data.

P204.XX ComHS

This parameter sets the handshake for the Comm Port to none, CTS (hardware), XON (software) or both. This setting applies to transmissions sent and received by the indicator.

P206.XX

RxCom enables or disables the RS232 receiver for accepting communications through the Comm Port.

P207.XX TxRTZ

This parameter sets a return range for use when you elect to transmit once per weighment and is only meaningful if the "wghmt" selection is made in parameter P210. After the applied weight exceeds the percentage of Full Scale specified by P207, a transmission will take place as soon as motion ceases, regardless of the motion selections made in P212. Before a second transmission can take place, the GROSS Weight must fall below this threshold. If the 100% selection is made, then one transmission will take place every time motion ceases, as long as the Gross Weight is not within +/-2 divisions of zero. Note that motion is defined by parameters P114 and P115.

P208.XX Width

This parameter sets the number of characters (0 through 15) that are transmitted for numeric parameters if a fixed width format is used within the Custom Transmit (refer to Chapter 4). If more characters than specified by this parameter are needed to represent the data being sent, then more characters will be sent.

P209.XX TxHld

This parameter lets you select whether a transmission will be held up or aborted when the transmit out buffer becomes full. Some explanation of the transmission routine of the indicator may help determine your selection here: There is one transmit buffer in the indicator, one for the COMM Port. The buffer is 256 bytes in size. As soon as this happens, the transmission of data begins. If the entire transmission will not fit into the buffer, the indicator will check the selection for this parameter. If the selection is "hold", then the indicator will wait for additional room to become available in the buffer so that it may resume filling the buffer. If no space is made available within two seconds, then the warning message "tx on hold" will be displayed until buffer space becomes available. At this

time the message "tx cont'd" will be displayed. If the **[CLR]** key is pressed, the transmission will be aborted. During the time that the indicator is attempting to fill the buffer with data to transmit, it is not performing its regular task of determining the currently applied weight and updating the display, the setpoint outputs or the analog output. If "abort" is selected, then as soon as the transmit buffer becomes full, the transmission will be immediately aborted. A warning message, "tx abort", will appear for one second. In any case, any characters which were already in the buffer when a transmission is aborted will remain in the buffer and will be transmitted when the handshake is re-established. The buffered characters are lost only if the indicator is powered down. Therefore, P209 should normally be set for delay in order to insure against undesirable loss of transmitted data. Only in the case of critical setpoint or analog output control applications should the abort selection be made.

8.2 Cable Connection Information

Refer to Figure 8-1 which shows the rear panel view of the indicator. Note that two rear panel strain reliefs are available for various cable connections. There are more options available for the indicator than cable ports. It is not possible to make connections to every available option feature in one indicator. The menu of possible external connections could include:

Communication Port
Bar-code Scanner
Remote PC Keyboard
External Setpoint Option (two setpoint outputs)
Relay Module Option

Therefore, if more than two of these features are required in any one application, then planning is required to combine connections for some of the options into one cable. This should be accomplished in a manner which will reduce the required number of cables to a maximum of two. Note that the external Setpoint Option is provided with a dedicated cable and may not be combined with other cables.

IMPORTANT
The Model 450/455 indicator does not include an on/off switch and therefore must be installed near a power outlet socket that is easily accessible. This is in keeping within UL/CSA approval requirements.

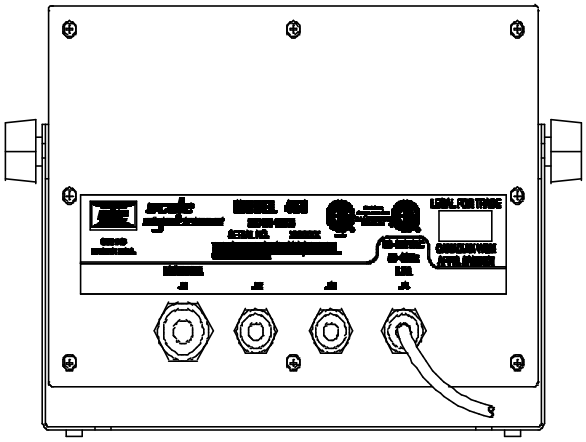

Figure 8-1 Model 450 Rear Panel

Several interface cables specifically designed for connection to the indicator are available.

CAUTION

Any operation which involves opening the enclosure should be performed by qualified service personnel only after disconnecting the power! Hazardous voltage is accessible within the indicator.

8.3 Communication Connections

If communication cables exist, they should be routed into the indicator through the rear panel strain relief marked J2 and J3. These strain reliefs are designed to accommodate cables ranging in diameter from 0.187" to 0.312". Wires may range in size from 28 to 20 AWG. Insulation resistance should be rated at a minimum of 30 volts. Use a cable with a braid or a foil shield and drain wire. A braided shield will perform better in high electrical noise environments. The capacitance rating of the cable should be low for long cable runs.

The shield for the communications cable should be grounded to the closest available rear panel stud inside

the indicator, keeping the length of the shield between the stud and the end of the cable jacket to an absolute minimum, and the length of unshielded wires to a minimum. This is important in order to reduce the effects of EMI, RFI, and ESD on the indicator operation.

8.3.1 Communication Port Connections (COMM Port)

The COMM Port is designated for communicating from the indicator to another smart device, and your application will dictate the required connections and the required number of conductors. Refer to Table 8-1. COMM Port Connections, which lists six different communication methods, and the required connections. It is also necessary to define which of the six methods you are using to the software in the indicator. Parameter P204 of the setup mode is used to determine the handshaking used by the indicator for the Communication (Comm) Port. If P204 is set for "com HS Xon" or "com HS both" then connections to both RX and TX are required. If either "Com HS CTS" or "Com HS both" are selected, then the CTS and RTS physical wiring connections must be made. The communication port may be used in a uni-directional manner if desired and the appropriate bi-directional connections may be omitted.

Note that RTS “LOW” (-12VDC) indicates “not ready”. RTS “HIGH” (12VDC) indicates “ready” when transmitting.

Function	Connections
Bi-directional with software handshake, or Bi-directional with no handshake, or Uni-directional with software handshake.	TX RX GND
Bi-directional with hardware handshake or "both" handshake.	TX RX CTS RTS GND
Uni-directional with hardware handshake (transmit only).	TX CTS GND
Uni-directional with hardware handshake (receive only).	RX RTS GND
Uni-directional with no handshake (transmit only).	TX GND
Uni-directional with no handshake (receive only).	RX GND

Table 8-1 COMM Port Connections

8.3.2 Peripheral Inputs

The indicator permits up to two other peripherals to send RS-232 data. These inputs to the indicator are intended for use with bar-code scanners and external keyboards.

Both a TTL input and an RS-232 input are provided, along with connections for +5 volts and ground. GSE provides a cable which at one end will connect to the terminal strip on the main board inside the indicator and the other end will provide the mating connector to the keyboard and bar-code scanners that GSE provides as peripheral devices.

8.3.3 Communications Cables

1. Strip back the jacket of the communications cable 7" for the J4 strain relief, and 8" for the J2 strain relief.

2. Strip the insulation of each conductor back 1/4".

3. Twist the strands of each wire so that no strands are loose. If desired, tin the wires to insure the strands will not come loose. Use a minimal amount of solder so that the wire will fit into the connector.

4. Cables for the Comm Port or peripheral devices can be routed through any one of the available rear panel strain reliefs, J2 or J3. Loosen the strain relief and route the cable(s) through.

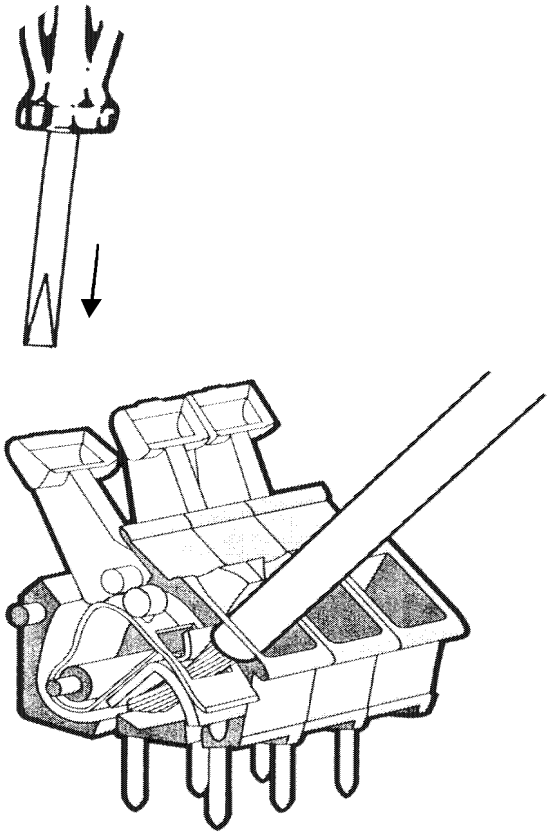

Figure 8-2 Connector

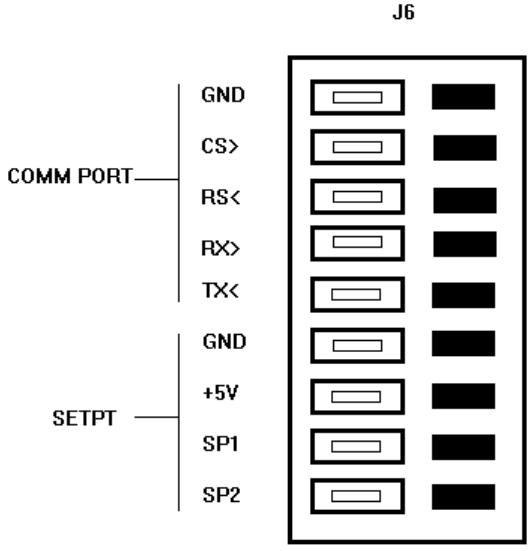

Figure 8-3 RS232 Port (J6)

5. Ground the shield to the stud adjacent to the strain reliefs at either J2 or J3, whichever is closer. (main board mounting studs).

6. The RS-232 ports and their functions are imprinted on the main PC board. Refer to Figure 8-3 and Table 8-1 to determine your required connections.

7. Insert each wire into its proper connection on J6 of the main PC board, as described for your chosen connection configuration in Table 8-1 COMM Port . Then secure all of the wires together with a tie wrap (supplied in a bag with the User's Guide) adjacent to the J6 connector. This will insure that in case a single wire comes loose, it will not come into contact with a hazardous voltage!

8. Once the wires and shield have been connected, pull any excess cable out of the instrument

NOTE:
Transmissions received by the indicator through the Comm port or from an external keyboard or a barcode device are all or'd together inside the indicator. Only one external device can be sending data to the indicator at any one time. Otherwise communications errors, garbled data, and unpredictable results may occur! Care must be taken in the implementation of these devices to insure proper operation.

through the strain relief to eliminate any slack between the shield termination and the strain relief. Then securely tighten the strain relief.

8.4 Custom Transmit (Selections) Parameter Setup

The Model 450 indicator includes a setup table for one Custom Transmit (999 characters). The next group of parameters determine the available selections for enabling this feature. The 455 has 2 additional custom transmit tables for truck mode operations only (999 characters each).

P210.XX Send1

determines when the data specified by the 1st Custom Transmit is transmitted: P210.00 disables transmissions; P210.01 enables transmissions when the **[PRINT]** key is pressed; P210.02 selects a continuous print function which will send a transmission each time the display is updated (per P117); P210.03 will transmit once per weighment (refer to P207).

P212.XX Mot'n

enables or disables motion delay on the transmission. The selection of this parameter applies to all selections for P210 above except for P210.03.

8.5 Communications (Receive) Operations

Any command that the Model 450 Weigh Indicator is capable of executing can be sent in from a remote source via a serial, asynchronous RS-232 communication link. Application uses for this capability include bar-code input of data, host computer interfacing and the transmission of setup files directly into the indicator. (Also refer to section on information parameters in regards to Download and Upload).

8.5.1 Command Language

The command language used by the indicator is based upon use of the percent (%) character. Any character received after a percent character is treated as a

NOTE:
P201 must be set to 8 bits in order for this feature to work properly.

command, provided it is a recognized code. Any invalid commands that are received are ignored. Lower case characters are used for the commands which represent keys on the indicator front panel. Capital letters and a few other characters are used for commands designed primarily for use within Macros. (The indicator % command character is similar in nature to "ESCape" codes used to program printers).

Table 8-2 shows a listing of RS-232 Keyboard Commands used to simulate the front panel keys.

If an entry is in process and a carriage return is received, then the entry is cleared. Otherwise the carriage return does not affect the operation of the indicator. However, every carriage return that is received is counted by the indicator as a means of tracking down errors.

Commands may also be sent to the indicator as single 8 bit characters which is the character with the high bit set. Sending these extended ASCII codes is not normally necessary and it is better to simply send the "%" character followed by the appropriate command.

8.5.2 Receiving data

The indicator has a 256 byte received data buffer. When characters are received, they are stored in this buffer until the indicator has a chance to process the received data. When the buffer has 240 characters buffered, leaving room for only 16 more, the indicator will de-assert its handshake output, as specified by setup parameter P204. In other words, the indicator will transmit an XOFF character and / or change the level of its CTS output to -12v. If the transmitting device continues to send more than 16 characters after the indicator's handshake output has been de-asserted then characters may be lost. This situation constitutes an over-run error and is indicated by the message ovrun error.

As soon as the available room in the data receive buffer increases to at least 24 characters, the indicator re-asserts its handshake outputs, informing the transmitting device that it is OK to resume transmitting. Note however that the hardware handshake output of the indicator is always asserted and de-asserted when appropriate, regardless of the selection for P204. This has been designed-in for trouble-shooting purposes. It is assumed that if you do not want to use the hardware handshake line then you will not connect it. For this situation it would not matter if the line changed state during a transmission.

While in the Weighing Mode, the indicator checks its receive buffer and processes any received data approximately every 1/20th of a second. While in the Setup Mode, the received data is processed more rapidly.

8.6 Communications (Transmit) Operations

The indicator provides a customized transmit mode for basic settings such as Motion Inhibit, etc. and a single transmission format table to send a variety of information to other devices. A custom transmit can be made up of variable information displayed or stored by the indicator, fixed ASCII characters and control codes. Up to 999 elements may be programmed for transmission setups, with each fixed character and programmed parameter counting as one element. As a maximum example, 12 parameters and 987 fixed discrete characters may be programmed for transmission.

8.6.1 Creating a Custom Transmit Setup

Before attempting to set up a Custom Transmit, determine ahead of time exactly what information you want to send. Advance to the Custom Transmit Setup. For example, press **[1000] [SELECT]** for the Custom Transmit table.

NOTE:
If entering this mode from the Weigh Mode, you will be asked to enter the Software Security Code. Enter the code as explained in Chapter 3 and the mode will be advanced to the specified parameter, in this case P1000.

To insure a fresh start, you should clear out the previous contents of the Custom Transmit Setup by pressing the **[SELECT]** key and move to the end of the table. Press **[ZERO]** + **[TARE]** simultaneously. The indicator will prompt you with "**CLR ALL?**", press **[ENTER]** to clear table. The **[CLR]** key will abort the operation. On a 455 key in **[1999] [SELECT] [ENTER]**.

To serially clear the custom transmit table the following string of characters via the 450's com port: **1999%s%c%e**. The number 1999%s takes the unit to the end of the custom transmit table. The %c%e will initiate the clear process with a safety verification. This string of characters should be at the beginning of the custom transmit section of the units text file setup.

Custom transmits 2 and 3 in the **455** are *cleared*

similarly but at different locations as shown below.

- **2999%s%c%e (2nd custom transmit)**
- **3999%s%c%e (3rd custom transmit)**

Enter the first element to be transmitted in the manner described for text, control code, or parameter, in the following sections. Repeat for each of the next elements. When complete, you may want to review the Parameter Setup in Chapter 4 for data transmission. When all parameter setups are complete, press **[ZERO]** to exit back to the Weigh Mode.

8.6.2 Basic Transmit Information

A default Custom Transmit is programmed into the indicator at the factory. This may be useful for your application. It may be modified to suit your purposes or cleared completely. The indicator is in an Insert Mode when data is entered into a Custom Transmit Setup. Entered data does not overwrite existing data. Instead, it is stored at the current location within the Custom Transmit Setup, immediately in front of the data that was at that location before the entry was begun. If previously entered data needs to be changed, you would first enter the new data, then delete the old data by pressing the **[ZERO]** + **[TARE]** simultaneously on a 450 or **[CLR]** on a 455. One character will be deleted each time these two keys are pressed.

There are several sub-modes of operation in the Custom Transmit Setup Mode. These are:

Viewing the previously set up transmission and entering new characters.

Expanding a special code to determine its setting.

Selecting a parameter to be transmitted.

Selecting the format for the selected parameter.

There are three different types of entries that can be made into the Custom Transmit Setup.

Fixed Text

Control Codes and Extended codes such as carriage returns, line feeds, etc.

Items such as Gross Weight, Date, Time, etc.

These entries are explained in the following sections.

8.6.3 Numeric Display During Setup

During the setup of a Custom Transmit, the numeric display will show P1XXX. , where the XXX indicates the number of the current entry location (starting at location 000). For example, when the first character of the Custom Transmit Setup is displayed in the lower right corner of the dot matrix display, the numeric display would read P1000. When the fourth character of that setup is displayed, the numeric display would read P1003.

8.6.4 Dot Matrix Display During Setup

The character programmed at the current location within the Custom Transmit Setup will be shown in the lower rightmost position of this display. Any preceding characters are shown ahead of it on the second and first lines of the display. For instance, if part number were entered, the display would show:

ART_N
UMBER

Special characters are used to represent the characters required to transmit parameters, control codes, ASCII extended codes, and the end of the table. Parameters are represented by a compound p/a while control codes and extended codes are represented by a single character combination c/c. These special characters may be expanded to clarify their use by pressing the **[PRINT]** and **[UNITS]** keys simultaneously. Control codes, standard ASCII characters and extended codes (greater than 127 decimal) are expanded to their decimal value. In addition, control codes are also shown with their standard two or three character abbreviation and their control character representation. For example, the carriage return would be shown as:

<CR> ^M=13.

Extended codes are shown with the letters EXT-* where the * is replaced by the corresponding ASCII character. The parameter codes are expanded to a five character representation of their name along with a 3 digit code

representing the selected format for that parameter. For example, the Gross Weight being transmitted in format 3 would be depicted as: F:003 GROSS

Pressing this same key combination will un-explode the character and return to the custom transmit table.

The Dot Matrix Display is also used to prompt you through the process of selecting an item for transmission and during the process of deleting a previous setup.

8.6.5 Fixed Text Setup

(m450)
The Fixed Text portion of a transmission is entered into the setup where it is to appear within the transmitted data. A maximum of 49 characters may be entered at any one time before pressing **[ENTER]**. Press the **[PRINT]** or **[UNITS]** keys to begin an entry. The **[UNITS]** key places an A in the lower right position on the display. Use the **[PRINT]** key to scroll forward through all possible characters and **[PRINT] + [UNITS]** simultaneously to backup one step. Press **[UNITS]** when the desired character is displayed. This shifts the chosen character to the left making room for the next character, which is first displayed as an "A". This new character is then set to its desired value. Press **[UNITS]** and **[PRINT]** simultaneously to backup through the setup if required. When the text entry is complete, press the **[TARE]** key which doubles as an **[ENTER]** key to store the data. If an alpha keypad is available, then the text characters may be entered directly. Alpha keypads can used in a variety of ways such as with the GSE computer simulation of the indicator, by connecting a computer in terminal mode to the Comm Port of the indicator, by using the alpha keypad sold with the GSE Model 625 and 550/570/574, or by downloading a setup file from a computer through the Comm port of the indicator.

(M455)
The **[UNITS]** and **[TARGET]** keys double as **Up** and **Down** arrow keys respectively. While having accessed any mode or parameter which requires a character entry, the **[UNITS]** key will scroll through a set of ASCII characters. The **[TARGET]** key will scroll through the set in reverse. The **[TARE]** key or Right Arrow when pressed will move over to the next character position. The **[ID]** key or Left Arrow will backup to the previous character.

As entries are keyed into the entry buffer, the **[PRINT/ ENTER]** key will complete the entry for the 455.

NOTE:
Be careful when downloading the % character which is used to execute commands. If a % character is part of the transmit setup, then a double percent character %% must be entered. For those who prefer, the ASCII characters may be entered one at a time using their 3 digit decimal code number preceded by a decimal point entry. For example, to enter the letter Z you would

KEY	RS232 ASCII COMMAND	8 BIT HEX	8 BIT DECIMAL
ZERO	%z	FAH	250
UNITS	%u	F5H	245
SELECT	%s	F3H	243
PRINT	%p	F0H	240
TARE	%t	F4H	244
ENTER	%e	E5H	229
CLR	%c	E3H	227

Table 8-2 450 RS232 Keypad Commands

CONTROL CODE	DECIMAL VALUE	ABBREVIATION	DEFINITION
^@	000	NUL	Null Character
^A	001	SOH	Start of Header
^B	002	STX	Start of Text
^C	003	ETX	End of Text
^D	004	EOT	End of Transmission
^E	005	ENQ	Enquire
^F	006	ACK	Acknowledge
^G	007	BEL	Bell
^H	008	BS	Backspace
^I	009	HT	Horizontal Tab
^J	010	LF	Line Feed
^K	011	VT	Vertical Tab
^L	012	FF	Form Feed
^M	013	CR	Carriage Return
^N	014	SO	Shift Out
^O	015	SI	Shift In
^P	016	DLE	Data Link Escape
^Q	017	DC1	Device Control 1
^R	018	DC2	Device Control 2
^S	019	DC3	Device Control 3
^T	020	DC4	Device Control 4
^U	021	NAK	Negative Acknowledge
^V	022	SYN	Synchronous Idle
^W	023	ETB	End Transmission Block
^X	024	CAN	Cancel
^Y	025	EM	End of Medium
^Z	026	SUB	Substitute
^[	027	ESC	Escape
^\	028	FS	Field Separator
^]	029	GS	Group Separator
^^	030	RS	Record Separator
^(underline)	031	US	Unit Separator

Table 8-3 ASCII Control Codes

Parameter Name	ID#	Transmitted Name
Gross Weight	00	Gross
Net Weight	01	Net
Tare Weight	02	Tare
Gross Total	03	GrTOT
Net Total	06	NtTOT
Accumulation Counter	09	# Accum
Time/Date	11	Tm/Dt
Truck Gross	12	TrGrs
Truck Net	13	TrNet
Truck Tare	14	TrTar
ID#	21	ID#
Quantity	30	Qty
Quantity Total	31	Qty TOT
Piece Weight	34	APW
Piece Weight times 1000	35	APW*K
Last Sampled Amount	37	Sampl
Truck Time	50	TrTim
Target #1	80	Targ1
Target #2	84	Targ2
Activation Value #1	86	AVal1
Reset Value #1	87	RVal1
Activation Value #2	88	AVal#2
Reset Value #2	89	RVal#2
Register #1	91	Reg#1
Status Character	97	Stat
Currently Displayed Data	98	(variable depending on current display)

Table 8-4 Parameter ID Numbers

press **[.] [0] [9] [0] [ENTER]**. This entry procedure is the same as for ASCII control codes (see following section).

8.6.6 Control Code Setup

ASCII Control Codes (0 to 31) and Extended Codes (128 to 255) can only be programmed by keying in a decimal point followed by the three digit decimal value of the desired character. For instance, to transmit a line feed (which has a decimal value of 10), you would key in **[.] [0] [1] [0]** and press **[ENTER]**. A special code has been created which combines a carriage return with a line feed: **.256 [ENTER]**. However, this code still takes up two elements in the Custom Transmit Setup. Refer to Table 8-3, ASCII Control Codes for a complete list of codes.

8.6.7 Parameter Setup

Parameters stored by the indicator are added to a transmit by pressing the **[ENTER]** key while you are at the desired location of the Transmit Setup. The display will read Pick Parm: for about one second, then the display will read Parm= Gross. On a 450 press the **[PRINT]** key to scroll through the possible selections such as Net, Tare, Gross, etc (**[UNITS]** key on a 455). The **[UNITS]** key will step back one on a 450 (**[TARGET]** on a 455). Parameters may also be chosen by directly keying in their parameter number followed by **[ENTER]**. This simplifies creation of a computer based setup file. The available parameters and their numbers are listed in Table 8-4, Parameter ID Numbers. When the desired parameter is displayed, press the **[ENTER]** key. After the parameter is selected, the display will briefly show Set Formt, followed by Formt = 000. Enter a 3 digit code that specifies the exact way in which the parameter will be transmitted. A number between 000 and 255 are the possible entries. In most cases a format entry of 000 will suffice and the format entry process can be effectively ignored. However, if you want to send a parameter in a particular way, you must add up the values from a set of choices for that parameter and enter the sum as the format code. The format selections vary somewhat depending on the type of parameter that you selected. These are explained in the following section.

8.6.8 Numeric Parameter Format Selections

The selections for the numeric parameters calculated by

Selection	Example	Description
8	"1235."	Print decimal even if data has no fractional portion
16	"+1235"	Print + sign for positive data
32	"1235"	Do NOT print the parameter's units
64	"2720 lb"	Print the data in default units (as opposed to current units)
128	"1235"	Do NOT print the parameter's name

Table 8-5 Numeric Parameter Formats

Selection	Example	Description
0	"27.49"	Fixed width, right justified, left spaces filled
1	"0027.49"	Fixed width, right justified, left zeroes filled
2	"27.49"	Fixed width, left justified, padded w/spaces on right
3	"27.49"	Minimum width

Table 8-6 Numerical Parameter Field Width

Selection	Example	Description
1	"06:56:51 pm 05/15/93"	Includes seconds with time
2	"18:56 05/15/93"	24 hour time format
4	"06:56 pm May 15, 1993"	Print date spelled out
8	"06:56 pm Wed 15, 1993"	Print day of week
16	"06:56 pm 15/05/93"	International date format
32	"1235"	Do NOT print the parameter's units
64	"05/15/92"	Do NOT print time
128	"06:56 pm"	Do NOT print date

Table 8-7 Time / Date Format Selections

Format	Example	Description
32	"1235"	Do NOT print the parameter's units
68	"May 6, 1992"	Complete U.S.A. date
72	"Mon 05/06/92"	U.S.A. date with day of the week
80	"06/05/92"	International date
92	"Mon 6 May, 1992"	Complete International date with the day of the week
129	"01:11:30 pm"	12 hour time with seconds, without the date
131	"13:11:30"	24 hour time with seconds

Table 8-8 Time / Date Format examples

Selection	Description
0	Print the decimal point even if the data has no fractional value
16	Print a + sign for positive data
128	Do NOT print the parameter's name

Table 8-9 Basic Format Selections

Selection	Description
32	Increment number before it is transmitted
36	Decrement number before it is transmitted
64	Increment number after it is transmitted
68	Decrement number after it is transmitted
96	Increment number twice, once before and once after it is transmitted
100	Decrement number twice, once before and once after it is transmitted

Table 8-10 General Purpose Register Format Selections

Character	Description
O	Overload or Underload condition
M	Motion exists
(space)	No Overload or Underload or Motion exists

Table 8-11 Status Character Interpretation

Format Code	Effect	Example
0	Send Name	"Stat M"
128	Do NOT send Name	"M"

Table 8-12 Status Format Selection

Checksum Code	Function	Description
.300	stop	Stop calculating the checksum but do not transmit yet.
.301	CCITT	International standard CRC
.302	SDLC/HDLC	CRC used by IBM
.303	CRC-16	Most commonly used CRC in the United States
.304	CRC-12	Used when bytes are 6 bits
.305	LRCC-16	16 bit CRC
.306	LRCC-8	8 bit CRC, used by Epson
.307	XMODEM	Registers are shifted left, opposite CCITT method which shifts right. Used with transmissions up to 9600 baud.
.308	Sum 16	2 byte additive checksum
.309	Sum-8	1 byte additive checksum
.310	Send Checksum	Transmit checksum sending LSB first
.311	Send Checksum	Transmit checksum sending MSB first

Table 8-13 Checksum Format Codes

the Model 450 indicator (GROSS, NET, etc.) are described in Table 8-5, Numeric Parameter Formats and Table 8-6, Numerical Field Width. Note that the names of the units are sent in a variable width of up to 6 characters, consisting of a leading space followed by up to 5 characters of units name. Similarly, when selected, parameter names are always sent following the data and after the units name (if sent). The length of the parameter name will always be 5 characters for numeric parameters as this is the same name that is displayed when the parameter is selected during the Weigh Mode. If a more descriptive name is desired for the transmission, the format can be selected to send the data only with the descriptive name programmed into the Custom Transmit Setup as fixed text immediately preceding or following the transmitted data. Additional format options for the numeric parameters are divided into two categories as shown in Table 8-6. The first is Fixed Width where a specific number of digits are always transmitted for the data. The other variation is Minimum Width where only the digits necessary to represent the data are sent, so that fewer characters are sent for weights closer to zero. In any case, all transmitted data is formatted to the same number of decimal places as would be displayed. Choose **ONE** of the four choices in Table 8-6 and add its value to that selected from Table 8-5. If a fixed width is chosen, the fixed width that will be used is specified with setup parameter P208.XX as a value between 0 and 15. Also, the plus or minus sign, when printed, is included in the fixed width. If the transmitted data cannot be represented in the specified fixed width, additional characters are sent if needed. Thus very small values for fixed width, especially zero or one, will produce the same result as a minimum width selection!

8.6.9 Time/Date Parameter Format Selections

Time-Date is set up at the factory to transmit the *format* as: 16:56 pm 11/12/95. If this is satisfactory then the format code of 000 should be used. Otherwise, add up the indicated format codes for each of your selections in Table 8-7, Time / Date Format Selection. After adding up the selections from Table 8-7, the total should be entered as the format code for the Time/Date parameter. Each specific combination of choices results in the transmission of a specific number of characters. The number of transmitted characters is not dependent on the current time or date. An example of several combinations are shown Table 8-8, Time / Date Format Examples. Note that transmission of a parameter name along with the Time/Date is not available as a format choice. Additional text, such as Today's Date: , may be programmed as fixed

text into the Custom Transmit Setup in front of the Time/Date parameter entry. Refer to the section on Fixed Text and use of the % character.

8.6.10 Time/Date Transmit Code Update

Format code 32 allows a time / date type variable (current time) to be transmitted as a numeric value in terms of the number of seconds elapsed since Jan 1, 1970. This is useful in uploading time / date information to a computer for use in a spreadsheet application.

8.7 General Purpose Register Format Selections

The indicator has one general purpose register (parameters# 91) that that can be used for the printing of incrementing and decrementing values, such as box numbering, etc. The formatting choices are shown in Table 8-9 and 8-10. The values in Table 8-10 allow for incrementing or decrementing the transmitted number, before or after it is transmitted. You do NOT have to make a selection from Table 8-10. Add in the indicated value for each of the following format selections based upon your response to the following choices: Finally choose a field width value from Table 8-6 and add it to that determined from Tables 8-9 and 8-10. Remember that if the parameter name is transmitted, it is always sent following the data. The length of the parameter name will always be 5 characters for these parameters as this is the same name that is displayed when the parameter is selected during the Weigh Mode. If a more descriptive name is desired it can be programmed into the Custom Transmit Setup to be part of the fixed text transmission immediately preceding or following the data being transmitted.

8.7.1 Status Parameter

This parameter was added so that the indicator could transmit some information regarding its status, specifically concerning motion and overload conditions. The transmitted status will consist of a single character having three possible values as described in table 8-11 Status Character Interpretation. The only applicable format code for the status parameter is for the inclusion or exclusion of the parameter's name, Stat, which has a format code of 128, as shown in table 8-12 Status Format Selection.

8.8 Check-sums on Transmitted Data

In Europe, if a printer is not located adjacent to the indicator then the transmission must include a checksum and a mechanism to re-attempt a transmission in case of errors in order to be PTB approved.

Several different styles of checksums may now be calculated by the indicator to help insure the integrity of the transmitted data. One of these new checksum calculation methods matches that used by Epson in a protocol commonly used in Europe. Together with capabilities of the Input Interpreter (P900), the 450 indicator may now be used with these Epson printers, insuring correct data transfer by re-sending the transmission if the required acknowledge is not received.

A data checksum calculation consists of three commands:

1. Initialize and begin calculating a specific type of checksum starting with the next transmitted character.

2. Stop calculating the checksum (optional). Required only when the checksum is not to be transmitted until after some additional characters are transmitted.

3. Transmit the checksum. Since most supported checksums are two-byte, there are two commands, one for most significant byte (msb) first and one for least significant byte (lsb) first. Both bytes will be transmitted in succession. For single byte checksums, either command may be issued.

Several new codes have been defined which allow these commands to be embedded at the proper locations in a custom transmit or to be done at a particular time within a macro. Similar to the way a carriage return/ line feed combination may be programmed into a custom transmit setup by entering .256, the codes for

the checksum may be entered as shown in table 8-13, Checksum Format Codes.

Note that this feature only allows the transmitting of checksums, not the receiving of checksummed data.

Checksum codes are represented by a Ö symbol in the custom transmit table.

GSE Model 450 to Epson Printer

Implementing Epson "BT-90" Block Transfer (commonly used in Europe)

While there are numerous ways of accomplishing various tasks on the 450 (including the one at hand) below is one possible method.

Note: This example requires the use of M450 firmware dated Jul, 1995 or later (per P60102). The Block Proof character used in the Epson BT-90 interface is known as "LRCC-8".

The Custom transmit describes the format using CRCs.

100%s23640%i%e	Access Setup Modes, Allowing Changes
1999%s%c%e	P1000. Custom Transmit #1
.002%e	<STX>
.306%e	Check LRCC8
%e0%e%e0%e%e	Gross Format = 0
.256%e	<CR> <LF>
.003%e	<ETX>
.310%e	Check PrnLo
%z	Exit Setup Mode

8.9 Printing Operations

Pressing **[PRINT]** will print either the data which appears on the display, or the stored data and other information that was entered into a Custom Transmit Setup, depending upon how the transmission parameters have been set up. A default Custom Transmit Setup is programmed into your indicator at the factory. An example of which is shown below.

9876.54 lbs Gross Weight

Selection	RxKey Description
0	None!
1	Gross Accumulation
2	Net Accumulation
3	Print
4	Tare
5	Zero
6	Start

Table 8-14 RxKey Selections

9864.20 lbs Net Weight
12.34 lbs Tare Weight

There is a single Custom Transmit that may be set up in the indicator. To print a set up transmit, press **[PRINT]**.
Although all transmissions are usually begun by pressing the **[PRINT]** key, an exception is the Continuous Print feature which will transmit the programmed data each time the display is updated. This feature is particularly useful with a remote display or an interface with a computer that is monitoring the process.

If the receiving device (printer, display or computer) goes off line, is powered-down or for any other reason cannot receive the data being sent, the message Tx On Hold will appear for a few seconds.

Press **[CLR]** to abort the transmission. If this situation occurs while using the Continuous Transmit feature, the continuous transmission is suspended, but can be resumed by pressing the **[PRINT]** key.

8.10 Input Interpreter

Description

The Input Interpreter is a GSE feature that adds a powerful aspect to the GSE Model 450 Weigh Indicator. This feature, when enabled, operates on data received through the Indicator's serial COMM port. It enables the indicator to recognize specific commands which may be unique to other indicators. This option permits the GSE Indicator to be programmed to emulate identical commands from Weigh Indicators manufactured by other companies.

The Input Interpreter consists of 8 input specifications. Each specification operates independently and can be Line type, Character type, or left unused. When the received data matches one of the specifications, a specific remote key operation can be initiated.
A Character type input specification will match a single received character. Although the specification may be several characters long, only the first character is compared. When a match occurs, all preceding data is cleared, and if a **RxKey** is programmed (selected), it is initiated. RxKey selections are described in table 8-14.

With Line type input specifications, the received data is held in a buffer until a terminating character is received. This terminating character is programmable, but the default is a decimal 10, which is an ASCII LINEFEED. All Line type input specifications use the same terminating character.

When the terminating character is received, the data in the buffer is compared against the Line type input specifications. If a match is found and an RxKey is programmed, it is initiated. Whether or not a match is found, the buffer will be cleared of all data up to and including the terminating character.

Line specifications may contain text, control codes and parameters. If there are no parameters, the received data is simply compared against the specification, and they must be identical to be considered a match.

If there are parameters in the line specification, characters from the received data will be stored into that parameter. Characters before the parameter in the line specification must match characters in the received data. A match occurs when data has been stored into all parameters in the line specification.

Input specification format lines may be up to 255 characters long, however the input interpreter's input buffer is only 49 characters long, which is the maximum number of received data characters that may be interpreted. When this buffer fills up it is cleared.

8.10.1 Setup

The Input Interpreter is an advanced software feature. In order for it to function properly, it must be set-up properly. The setup is stored in electronically erasable programmable read-only memory (EEPROM) along with all the other scale setup information.

8.10.2 General Setup

The Input Interpreter may be enabled or disabled at setup Parameter 900. All remaining input interpreter setup parameters are always retained regardless of the setting of this parameter. When this parameter is enabled, all received serial data is captured and used by the input interpreter. When it is disabled, all serial data is received and used by the instrument's command processor.

The line type input specification terminating character is programmed at Parameter 901. For values from 0 to 99, the value is displayed on the numeric display, while the ASCII interpretation of it is shown on the lower line of the character display. For values greater than 99, only the value is displayed on the lower line of the character display.

For each of the eight input specifications, there are three parameters which must be set-up: type, format line and macro number.

8.10.3 Input Specification Type

The Type is programmed at parameter 9X0, (where X is the input specification number, 1 through 8). The choices for type are: 0 - Unusd (unused), 1 - Char (character) and 2 - Line (line). Enter the number of your selection followed by the **[ENTER]** key to select a specific selection or press **[ENTER]** by itself to scroll through the selections.

When the type is set to unused, the other two parameters for that input specification are not accessible and will not be retained in EEPROM. However, they are not cleared until exiting the setup

mode, so changing the type to unused and then back to char or line does not affect the input specification format line and macro setups.

8.10.4 Input Specification Format Line

The format line is programmed at Parameter 9X1, (where X is the input specification number, 1 through 8). The format line is displayed on the lower line of the character display, the edit position is the last character on the right. The numeric display shows the edit position's offset from the first character of the format line. A solid box character indicates the end of the format line, a small PA indicates a parameter and a small CC indicates a control code. Here the following keys perform special functions:

(m450)

[PRINT] [ZERO]	pressed simultaneously, moves the edit position left.
[UNITS]	Moves the edit position right and scrolls around to beginning of the table.
[PRINT] [UNITS]	pressed simultaneously expands character at edit position. Pressed again will de-expand the character or parameter.
[UNITS] or **[PRINT]**	Enter Alphanumeric entry mode
[ENTER]	With no entry, enters the parameter select mode Following an entry, inserts entry into format line at edit position.

(with a 450)

In the alphanumeric entry mode the **[PRINT]** key on the Model 450 and the **[PRINT]** + **[UNITS]** simultaneously are used to scroll up and down through the ASCII character set. The **[UNITS]** key moves the edit position one character to the right and places an "A" there.

(with a 455)

The **[UNITS]** and **[TARGET]** keys double as **Up** and **Down** arrow keys respectively. While having accessed any mode or parameter which requires a character entry, the **[UNITS]** key will scroll through a set of ASCII characters. The **[TARGET]** key will scroll through the set in reverse. The **[TARE]** key or Right Arrow when pressed will move over to the next character position. The **[ID]** key or Left Arrow will backup to the previous character.

As entries are keyed into the entry buffer, the **[PRINT/ ENTER]** key will complete the entry for the 455.

In the parameter select mode the **[SELECT]** on the Model 450 are used to scroll through the available parameters. The parameter number is displayed in the last 2 digits of the numeric display, If you know the parameter number you may enter it directly. When the name of the parameter you want is displayed, pressing **[ENTER]** will insert it into the format line at the edit position.

Control codes are inserted by entering ".XXX", when XXX is the decimal code for the control code. For example, ".013" **[ENTER]** inserts a carriage return at the edit position.

Use caution when using a "%" in the format line. In order to match a "%" in the received data, the format line must contain two percent signs, or "%%". To enter two percent signs in the setup mode requires that 4 percent signs be sent to the scale. A single percent sign has a special meaning for the input interpreter, which is discussed in the section For Programmers Only.

8.10.5 Input Specification RxKey Number

The RxKey number is programmed at Parameter 9X2, (where X is the input specification number, 1 through 8). Here you select the number of the **remote key operation** you want to initiate when a match is found. The choices are 0 through 6 (RxKey number). Enter the number of your selection followed by the **[ENTER]** key to select a specific selection or press **[ENTER]** by itself to scroll through the selections.

8.10.6 Operation

There are a few aspects of the Input Interpreter which deserve to be highlighted. Failure to fully understand these concepts may result in unacceptable operation of the Input Interpreter.

8.10.7 Termination Character

How you handle your terminating character is very important! Let's assume that you want the Indicator to execute a macro when it receives the word "START" through it's serial port. So you set up the input specification #1 to be line type, the format line to "START" and the RxKey number to 6 (start). The terminating character is set to 13, which is a carriage return.

This setup will work fine if what is sent to the scale is "START" followed by a carriage return. But if a line feed is sent following the carriage return, this will only work the first time, because the linefeed will remain in the buffer and be taken as the first character of the next transmission.

There are two ways around this. First, if you know the transmissions will always include a linefeed, then set the terminating character to 10 (linefeed) and insert the carriage return at the end of the format line.

Alternately, you could set up another input specification to be character type, with a linefeed as the format line, and **no** RxKey. This way, the linefeed will simply clear the buffer, which was already done by the carriage return, so in effect the linefeed is ignored. This would allow all line type input specifications to handle transmissions with or without a linefeed.

8.10.8 Multiple Parameters

Any Line type input specification may contain several parameters. Suppose you want the scale to receive and interpret the following transmission:
T2.234,TRGT30.15<CR>

The objective is to store "2.234" into the TARE register, "30.15" as the register for TARGET 1, and execute an RxKey when done (ie. START). This can be accomplished by setting up an input specification as line type, with a format line of "T<pa=TARE>,TRGT<pa=Targ1>", RxKey number is set to 6 (START), and the terminating character set to 13 (carriage return). Here <pa=TARE> means to insert the parameter TARE at that point in the format line.

If we receive an incomplete transmission, for example: T2.234,PW<CR> the data "2.234" will be stored in the TARE register, however nothing will be stored in the TARGET1 register. The RxKey will not be executed, because a match occurs only when data is stored into all the parameters in the format line.

8.10.9 Trailing Data

In an input specification with at least one parameter, any data following the last parameter's data but preceding the terminating character will be ignored. For example: a format line of "T<pa=TARE>" will match received data of "T2.234" and "T2.234 hello model 574".

To prevent this, "%5s" may be appended to the end of the format line, as in "T<pa=TARE>%5s". What this does is tell the input interpreter to store up to five characters of trailing data in a dummy parameter. If the received data contains trailing data, data will be stored into two parameters, TARE and the dummy. Since the format line contains only one parameter, a match has not occurred, and the RxKey is not executed.

8.10.10 Multiple Matches

The input specifications are checked in order from one to eight. If the received data could match more than one input specification, the first one checked that generates a match has priority. Once a match occurs, the comparison stops. The other input specifications are not checked.

8.10.11 Disabling the Input Interpreter

When enabled, the input interpreter software intercepts all received data, except for the following circumstances:
Input interpreter is disabled in the setup mode, parameter 100 and above. To download a new setup to the scale while input interpreter is enabled, you must enter the setup mode manually on a 450 by entering **[SELECT] + [ZERO]** simultaneously and then press **[SELECT] [ZERO] [PRINT] [UNITS] [TARE]** from the scale's keypad and proceed to parameter P900. On a 455 key in **[900] [SELECT] [23640] [ID] [ENTER]**.

Proceed to disable the input interpreter by toggling the **[ENTER]** key to "**disbl**".

8.10.12 Advanced Concepts

This section is included for use by programmers knowledgeable in the "C" programming language. Feel free to skip this section. An understanding of the concepts presented here is not necessary to using the input interpreter. It will however, allow a higher degree of flexibility in your custom applications.

8.10.13 For Programmers Only!

As you read the previous Trailing Data Section, you probably thought to yourself, "That %5s looks like a format string from a C language printf or scanf function!". You're right! A derivative of scanf is the heart of the line type input interpreter specification with parameters. This knowledge can be useful, as we'll see below.

There are three components used by the input interpreter: the input string, the format string and a parameter address list. The input string consists of the data up to but not including the terminating character.

The format string is derived from the format line which is input in the setup mode and stored in EEPROM. At power-up or when exiting the setup mode (when the display says "Doing Setup") the format line is scanned and all parameters are replaced by format codes appropriate to their type. The address list is also built so that scanf will know where to store the data for each parameter. One additional address is added to the end of the list, that of the dummy parameter for the trailing data previously discussed.

The format code for most parameters is "%f", for floating point data.

It is possible to override these format codes by inserting a "%" immediately before the parameter in the format line. Then you can enter your own format code ahead of the "%". If you have multiple parameters you have to insert your format codes ahead of the first overridden parameter's format code.

This can be useful for parsing fixed-width data that contains no delimiters, because the maximum field width can be specified. For example, "%5f%6f%<pa=Tare>%<pa=Targ1>" will store the first 5 characters of data in floating point format into Tare, and the next 6 characters in floating point format into Targ1.

Back to more worthwhile things now, an asterisk immediately following the percent sign will cause a field to be scanned but not stored. So if you know that there is a floating number in the incoming data that you want to ignore, use "%*f" to skip over it, or to skip a single character use "%*c".

This is not meant to be a tutorial on the uses of the scan function. Many resource books are available which go into much further depth. We have tried to suggest some possible ways of using it's characteristics to good advantage.

8.10.14 Parameter Setup Reference

Parameter	Selections	Description
900	0	Interpreter Disabled
	1	Interpreter Enabled
901	0 - 255	Line TypeTermination Character

(in the following, X is the input specification number, 1 through 8)

9X0	0	Unused *
	1	Character Type
	2	Line Type
9X1*		Text, Parms, Format Line control codes
9X2*	0 - 6	RxKey Number

(* when specification Type is set to unused, parameters 9X1 and 9X2 for that specification are not accessible.)

8.11 Input Interpreter Examples

Example #1:

The 450 input interpreter operation is designed to invoke remote key operations when it receives a specified piece of data via its comm port (refer to table 8-14).

This example will demonstrate the 450 receiving non-standard character commands from a computer to cycle through a filling operation. This example assumes that an older indicator is being upgraded to a 450. The older indicator is referred to as **XXX**. In many instances its easier and more economical for the customer to have the indicator replaced than it is upgrading the PC application operating software.

The previous indicator **(XXX)** responded to a "T" via its comm port to execute a tare operation. It responded to a "?" to perform a zero operation. It also responded to a "P" in order to transmit its displayed weight. The equivalent interpretation to these three commands for a GSE 450 is defined below.

XXX	GSE 450	FUNCTION
T	%t	tare operation
?	%z	zero operation
P	%p	print operation

The 450 can interpret up to eight different pieces of information. This example shows three. A fourth interpretation will be setup to start a filling operation. This is added to the PC application software to make the system operate more smoothly.

XXX	GSE 450	FUNCTION
T	%t	tare operation
?	%z	zero operation
P	%p	print operation
N/A	S	START fill

The following setup defines the four interpretations above at the **900.XX** parameters.

Initial setup:
900%s1%e P900.1 RxInp Enbld
901%s13%e P901.13 RxTrm <CR>

Interpretation #1: ZERO
910%s1%e P910.01 RxTyp Char
911%s%c%e P911.06 RxFmt
?%e
912%s5%e P912.05 RxKey **ZERO**

Interpretation #2: TARE
920%s1%e P920.01 RxTyp Char
921%s%c%e P921.06 RxFmt
T%e
922%s4%e P922.04 RxKey **TARE**

Interpretation #3: PRINT
930%s1%e P930.01 RxTyp Char
931%s%c%e P931.06 RxFmt
P%e
932%s3%e P932.03 RxKey **PRINT**

Interpretation #4: START Fill
940%s1%e P940.01 RxTyp Char
941%s%c%e P941.06 RxFmt
S%e
942%s6%e P942.06 RxKey **START**

Interpretation #5, 6, 7 and 8: Unused
950%s0%e P950.00 RxTyp Unusd
960%s0%e P960.00 RxTyp Unusd
970%s0%e P970.00 RxTyp Unusd
980%s0%e P980.00 RxTyp Unusd

Custom Transmit (displayed weight, <CR> <LF>)
1000%s%c1000%e
%e98%e%e0%e%e
.256%e

8.11.1 Operation

As the 450 receives a "?", it will interpret this as a %z and perform a zero operation. At regular intervals, the PC application software will perform a zero operation. Remember, this is an old PC application software routine. The 450 interprets this character and performs the same operation.

The filling operation is ready to resume. A container is placed on the scale and the computer transmits a "T" via the 450's comm port. The 450 interprets this as a %t and tares out the container.

The computer continues to poll the 450 with a "P". This is interpreted as a %p and the indicator sends back its custom transmit containing the 450's displayed weight. This will allow the computer to determine that the tare operation has been properly performed. If the tare operation was performed properly, the indicator should respond with a zero net value.

Once the computer has determined that the tare is acceptable, it initiates a start of fill operation. This section