

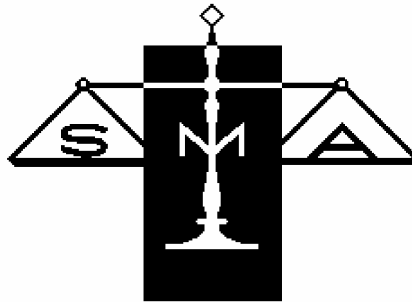
Scale Manufacturers Association

Standard

Scale Serial Communication Protocol

Levels #1 and #2

(SMA SCP-0499)



First Edition

Approved By SMA

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TABLE OF CONTENTS

CHANGE RECORD AND FOREWORD	2
INTRODUCTION	3
2.0 GENERAL	3
2.1 SIMPLE COMMAND SET	3
2.2 IMMEDIATE RESPONSE	3
2.3 UNIQUE COMMAND AND RESPONSE START/END CODES	4
2.4 EASE OF PROGRAMMING	4
2.5 HARDWARE	4
2.5.1 PHYSICAL LAYER	4
2.5.2 COMMUNICATION RATE	4
3.0 KEY TO SYMBOLS USED	5
4.0 THE SCALE COMMAND SET	6
4.1 REQUEST DISPLAYED WEIGHT (SMA#1)	6
4.2 REQUEST HIGH-RESOLUTION WEIGHT	6
4.3 REQUEST DISPLAYED WEIGHT AFTER STABILITY	6
4.4 REQUEST HIGH-RESOLUTION WEIGHT AFTER STABILITY	7
4.5 REQUEST SCALE TO ZERO (SMA#1)	7
4.6 REQUEST SCALE TO TARE	7
4.7 SET SCALE TARE WEIGHT	7
4.8 RETURN TARE WEIGHT	8
4.9 CLEAR SCALE TARE WEIGHT	8
4.10 CHANGE UNITS OF MEASURE TOGGLE OR SCROLL	8
4.11 SET UNITS OF MEASURE	8
4.12 INVOKE SCALE DIAGNOSTICS (SMA#1)	8
4.13 ABOUT SCALE FIRST LINE (SMA#1)	9
4.14 ABOUT SCALE SCROLL (SMA#1)	9
4.15 SCALE INFORMATION	9
4.16 SCALE INFORMATION SCROLL	9
4.17 EXTENDED COMMAND SET (CUSTOM)	9
4.18 ABORT COMMAND (SMA#1)	10
4.19 COMMANDS WITH UNSOLICITED RESPONSE	10
4.19.1 REPEAT DISPLAYED WEIGHT CONTINUOUSLY	10
4.19.2 REPEAT HIGH-RESOLUTION WEIGHT CONTINUOUSLY	10
5.0 THE SCALE RESPONSE MESSAGES	11
5.1 STANDARD SCALE RESPONSE MESSAGE	11
5.2 UNRECOGNIZED COMMAND RESPONSE	12
5.3 COMMUNICATION ERROR RESPONSE	12
5.4 DIAGNOSTICS COMMAND RESPONSE	13
5.5 ABOUT 'A' AND 'B' COMMAND RESPONSE	13
5.6 SCALE INFORMATION 'I' AND 'N' COMMAND RESPONSE	14
5.7 COMMUNICATION ERROR HANDLING	16
6.0 COMPLIANCE LEVELS	17
6.1 LEVEL #1	17
6.2 LEVEL #2	17
7.0 APPROVED UNITS OF MEASURE ABBREVIATIONS:	18
ANNEX A	19
ANNEX B	20

CHANGE RECORD

Nov 28, 2005 - 4.5 Request Scale to Zero (SMA#1) - Corrected Typo

<LF><Z><r><n><m><f><xxxxxx.xxx><uuu><CR> to read
<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

FOREWORD

- A. The intent of this Scale Serial Communication Protocol Standard is to make common the method for weighing scale communication across all scale manufacturers. By the adoption of this standard, by the SMA, this will create a more open architecture for weighing devices and allow a standard for scale connectivity across many different manufacturers.
- B. This standard contains the basic requirements for *limited feature* scale products to communicate weight and status information to a smart host device. It was determined by the SMA Standards Committee, early on during the specification process, that all the requirements for all of the different types of scale products in the world could not be addressed by one all encompassing standard. There are many weighing devices with varying computing power and application intent. To name just a few: Industrial, Retail, and Postal applications all required some of the “same but different” scale weight requirements. That is why the Standards Committee decided to address only the requirements for a *limited feature* weighing scale device at this time. Even after recognizing that we could only take this first step toward communication standardization, we found it necessary to address two levels of scale communication in this standard. Hence, we have devised SMA level ‘#1’ for the most *limited feature* of scale weighing devices and SMA level ‘#2’ for the more powerful, fully featured scale device. Because of the varied applicational needs for scale communication, this Standards Committee has decided to continue to meet in the future and tackle other serial communications protocols, but only after the base line is set with SMA levels #1 and #2.

A *limited feature* scale is defined as a weighing device with only limited microprocessor capabilities. There are a number of microprocessors that fall into this category due to either processing power or because of limited memory space availability. This SMA Standards Committee did not wish to preclude such *limited feature* scale devices from being SMA compliant. More robust scales may wish to implement this standard in its entirety. It is up to the manufacturer to design in which level of this standard their scale will comply with based on the requirements of the device placed in the market. All devices must comply with the requirements of SMA level #1, at a minimum, in order to claim SMA Serial Communication compliance.

INTRODUCTION

- 1.1 The requirements of this Serial Communication Standard cover *limited feature* weighing scale devices. By definition this means a scale device that only performs weighing functions and does not have specific firmware installed to satisfy specific applications without the help of a smarter host device connected to it. The sole job of this *limited feature* weighing device is to determine weight and communicate this weight information to the host device.
- 1.2 To keep the protocol simple, this standard outlines a “Master/Slave” or “Command/Response” methodology as the basis for the serial communications protocol. The host is always the commanding device and the scale will never send unsolicited responses to the host. This keeps the protocol quite simple without need for complicated error handling mechanisms to ensure both command and response validity.

2.0 General

2.1 Simple Command Set

Each scale command is a single ASCII character that is sent by the host and causes the scale to send back a single response. The list of these commands is documented in the standard that follows for both SMA Levels #1 and #2.

2.2 Immediate Response

Because of the “Command/Response” nature of this communication protocol, each command that the host issues to the scale expects an immediate response from the scale. This affords a level of error handling because if the host does not get a response during a reasonable time period it can then assume a communication error. The host can then take action to determine the nature of the error by either re-issuing the command or sending the ‘Abort’ command to command the scale to perform a soft reset.

There are several commands that wait for specific scale conditions to be cleared before a response can be sent. Most of these are the commands that require a stable weight on the scale before the response can be sent back to the host device. In these cases it is up to the “smarter” host device to determine the proper scale response time-out criteria and take appropriate action based on the specific application requirements. Once the scale is commanded to perform an operation it will take all the time necessary to perform that operation before issuing the proper response. In most cases however the response is immediate.

2.3 Unique Command and Response Start/End Codes

Each host-scale command and scale-host response is bracketed by unique ASCII Start/End Codes. The start code is always an ASCII <LF> '0AH' character and the end code is always and ASCII <CR> '0DH' character. Hence, host commands and scale responses take on the format <LF><command or response><CR>.

This method was chosen because a scale service technician with a simple terminal or computer with a terminal emulation program can command the scale to perform tasks without the need for special diagnostic software tools. The beginning <LF> and ending <CR> code will keep the scale communications lined up properly on the technician's terminal display screen.

2.4 Ease of Programming

It is the intent of this standard to make both scale and host programming as simple and easy as possible. This was accomplished by the use of explicit commands and responses. For each host command there is an expected response with the scale information framed in a format as documented by this standard. Each command, for the most part, is a single character command and each scale response is sent in a "fixed field" data format. In this way both the scale command parser and response generation code is simple to implement even for a scale device with limited computing power.

2.5 Hardware

2.5.1 Physical Layer

As the name implies, this is a Serial Communication Standard. As mentioned in the FOREWORD, the members for the Standards Committee intend to investigate requirements for other communications in the future. For the purpose of this first standard "serial" means simple half-duplex RS-232, TTL or 20mA current loop, asynchronous communications methods. All of these methods support both send and receive communication lines and are within the scope of this standard. There are many other methods of communication that are available (RS-422/485, Ethernet, CAN, USB...), these are all outside the scope of this first SMA Standard.

**Physical Layer - Reference Seven Layer ISO Communication Model*

2.5.2 Communication Rate

Most weighing devices today support a variety of baud rates, data frame sizes, and parity and stop bits. For the purposes of this standard, the default for these criteria will be the standard PC default: 96, n, 8, 1

Baud Rate	9600
Data bits	8
Parity	none
Stop bits	1

Note: Other combinations can be used at the manufacturer's discretion but this default configuration must always be available.

3.0 Key to Symbols Used

All characters used in this standard are printable ASCII except <CR> <LF> <SPACE> and <ESC>.

<>	Greater and less than symbols are used to bracket communication fields and identify non-printable ASCII characters. They are never a part of any actual communication message.
<LF>	Line Feed character used for start of data frame (0A hex).
<CR>	Carriage Return character used for end of data frame (0D hex).
'_' <space>	The underscore or <space> are used to denote an ASCII space character (20 Hex).
<ESC>	Escape character used as an abort command (1B hex).
'!'	ASCII exclamation mark character is used for a data communication error. (21 hex).
':'	ASCII colon used as a field delimiter (3A hex)
'-'	ASCII center dash character (2D hex)
'?'	ASCII question mark character is used for unrecognized or unsupported commands (3F hex).
'c'	Command characters all printable ASCII characters.
<s><r><n>	Scale status indicators; ASCII letter characters or space
<m><f>	<i>See Section 5.1 for exact status details.</i>
<r><e>	Scale diagnostic indicators; ASCII uppercase characters or space
<c><m>	<i>See Section 5.4 for exact status details</i>
<xxxxxx.xxx>	Weight data including minus sign (right justified when needed) and decimal point (if needed). Leading spaces are used with a leading zero to the left of the decimal point if needed. This field is always fixed at 10 characters in length. Pounds/ounce requires a special format, where the pound field is delimited from the ounce field by a ':' colon. During some error condition this field is filled with '-' dashes. Examples: <_ _ _ _ _0.000> <_ _ _ _ _11.120> <_ _ _ _ _-1.000> <_ _ _ _ _1:08.0> <- - - - ->
<yyyyyy>	Text field of printable ASCII characters used to convey scale information. This field will not exceed a maximum of 25 characters.
<uuu>	Unit-of-Measure abbreviation. This field is always 3 characters long with a trailing space(s) when appropriate.

See Section 7.0 for the list of Unit-of-Measure abbreviations.

4.0 The Scale Command Set

The following section defines the host commands that are used to command the scale to either send information or perform operations as directed. Because there are two levels of SMA protocols defined in this section all of the *limited feature* scale (or the minimum command set) is denoted by (SMA#1). It is up to the manufactures application need to determine how many of the (SMA#2) commands are implemented.

All scale commands start with a <LF> and end with a <CR> to ensure proper handling by the scale.

Format: <LF>c<CR>

4.1 Request Displayed Weight (SMA#1)

Command: <LF>W<CR>

Response: Scale returns **Weight** and status information immediately.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.2 Request High-Resolution Weight

Command: <LF>H<CR>

Response: Scale returns **High-resolution** (10x) weight and status information immediately.

Note: the gross/net status indicator <n> will be in lower case during high-resolution weight transmission.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.3 Request Displayed Weight after Stability

Command: <LF>P<CR>

Response: Scale returns displayed weight (or **Print** weight) and status information only after scale has achieved a stable weight. Since this command can have a significant delay between command and response, it up to the host to determine the proper error time-out.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.4 Request High-Resolution Weight after Stability

Command: <LF>Q<CR>

Response: Scale returns high-resolution (10x) weight (or print weight) and status information only after scale has achieved a stable weight. Since this command can have a significant delay between command and response, it up to the host to determine the proper error time-out.

Note: the gross/net status indicator <n> will be lower case during high-resolution weight transmission.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.5 Request Scale to Zero (SMA#1)

Command: <LF>Z<CR>

Response: Scale attempts to zero itself and reports zero status in the <s> status indicator.

Note: in many locations latching the scale zero command is not permitted. The specific conditions for scale zeroing will meet proper Weights and Measures criteria.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.6 Request Scale to Tare

Command: <LF>T<CR>

Response: Scale attempts to **tare** itself using the weight on the scale display and reports the tare status in the <s> and <n> status indicators. If a tare error occurred this is only a momentary error status indicator and will be cleared on the next command cycle.

Note: in many locations latching the scale Tare command is not permitted. The specific conditions for scale tare will meet proper Weights and Measures criteria.

<LF><s><r><N><m><f><xxxxxx.xxx><uuu><CR>

4.7 Set Scale Tare Weight

Command: <LF>T<xxxxxx.xxx><CR>

Response: Scale attempts to take the <xxxxxx.xxx> data as the tare weight and reports the tare status in the <s> and <n> status indicators. If a tare error occurred this is only a momentary error status indicator and will be cleared on the next command cycle.

<LF><s><r><N><m><f><xxxxxx.xxx><uuu><CR>

4.8 Return Tare Weight

Command: <LF>M<CR>

Response: Scale returns tare weight stored in scale Memory and identifies the weight as tare in the <n> status indicator.

<LF><s><r><T><m><f><xxxxxx.xxx><uuu><CR>

4.9 Clear Scale Tare Weight

Command: <LF>C<CR>

Response: Scale Clears tare weight and reports the tare status in the <n> status indicator.

<LF><s><r><G><m><f><xxxxxx.xxx><uuu><CR>

4.10 Change Units of Measure Toggle or Scroll

Command: <LF>U<CR>

Response: Scale will toggle or scroll between pre-programmed Units of Measure and reports its current units in the <uuu> field.

See Section 7.0 for recognized units of measure abbreviations.

<LF><s><r><n><m><f><xxxxxx.xxx><kg_><CR>

4.11 Set Units of Measure

Command: <LF>U<uuu><CR>

Response: Scale will change to selected Unit of Measure and reports its current units in the <uuu> field.

Note: non-recognized <uuu> strings will be ignored by scale.

See Section 7.0 for recognized units of measure abbreviations.

<LF><s><r><n><m><f><xxxxxx.xxx><kg_><CR>

4.12 Invoke Scale Diagnostics (SMA#1)

Command: <LF>D<CR>

Response: The scale runs scale diagnostics and sends a diagnostic response message with the results of the tests.

See Section 5.4 for response details.

<LF><r><e><c><m><CR>

4.13 About Scale First Line (SMA#1)

Command: <LF>A<CR>

Response: The scale will send the first line of the **A**bout scale data.
See Section 5.5 for response details.

<LF><SMA>:<yyyyyy><CR>

4.14 About Scale Scroll (SMA#1)

Command: <LF>B<CR>

Response: The scale will send the rest of the **A**Bout the scale data.
See Section 5.5 for response details.

<LF><MFG>:<yyyyyy><CR>

4.15 Scale Information

Command: <LF>I<CR>

Response: The scale will send the first line of the scale **I**nformation data.
See Section 5.6 for response details.

<LF><SMA>:<yyyyyy><CR>

4.16 Scale Information Scroll

Command: <LF>N<CR>

Response: The scale will send the rest of the scale **I**Nformation data.
See Section 5.6 for response details.

<LF><TYP>:<yyyyyy><CR>

4.17 Extended Command Set (custom)

Command: <LF>Xc<CR>

Response: This is the only two-character command in this protocol. It is intended for the manufacturer to extend or customize the protocol for uses outside the scope of this standard.
'c' is any printable ASCII character the manufacturer desires.

<LF><manufacturers specified response><CR>

4.18 Abort Command (SMA#1)

Command: <ESC>

Response: This is the only command that the scale receives which does not follow the <LF>c<CR> protocol and does not have a response. This was implemented this way so that the <ESC> character can be detected at the scales “*Data Link Layer” and a software reset generated regardless of what the scale is doing at the time. This software reset should reset the communication hardware and clear any pending commands that the scale is acting on. This command is needed to reset the scale if the host has commanded the scale to perform an operation that has taken longer than the host is willing to wait. After the <ESC> command is issued the host should wait several seconds before trying to communicate with the scale to ensure the scale has completed its software reset cycle. It is recommended that the host then issue a simple “About” command ‘A’ to validate that the scale is again communicating properly.

**Reference Seven Layer ISO Communication Model*

4.19 Commands with Unsolicited Response

The following section defines the host commands that are not considered strictly command/response. This is because the scale will respond continuously as commanded to do so by the host. Because of the fact that these commands require a somewhat different, more powerful, host protocol implementation they are referenced in this separate section.

Note: When the scale is operating in one of the continuous output modes any single response command from the host will restore the scale to normal command/response operation right after the last weight string is sent.

4.19.1 Repeat Displayed Weight Continuously

Command: <LF>R<CR>

Response: Scale Repeats weight and status information continuously until another command is received.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

4.19.2 Repeat High-Resolution Weight Continuously

Command: <LF>S<CR>

Response: Scale repeats high-resolution weight and status information until another command is received.

Note: the gross/net status indicator <n> will be lower case during high-resolution weight transmission.

<LF><s><r><n><m><f><xxxxxx.xxx><uuu><CR>

5.0 The Scale Response Messages

This section details each scale response to host-scale commands. To keep this protocol simple each response has been designed in a “fixed field” data format. Every response is deterministic with only a scale communication error being the exception. The host can parse the scale response message with explicit rules because each field of each response message is in a fixed position format.

5.1 Standard Scale Response Message

Most of the host commands are responded to in the following message format. The only host commands that do not are the:

Diagnostics, **A**Bout and **I**Nformation commands

<LF> <s> <r> <n> <m> <f> <xxxxxx.xxx> <uuu> <CR>

where:

<LF>	Start of response message	
<s>	scale status	definition / example
	‘Z’	Center of Z ero <xxxxxx.xxx>= 0.000
	‘O’	O ver Capacity <xxxxxx.xxx>= +weight
	‘U’	U nder Capacity <xxxxxx.xxx>= -weight
	‘E’	Z ero E rror (clears when condition clears)
	‘I’	I nitial- Z ero Error (if used, this error is maintained until zero condition is cleared)
	‘T’	T are Error (clears after being read)
	<space>	None of the above conditions
		<i>Note: For ‘E’, ‘I’, ‘T’ error conditions <xxxxxx.xxx>= ————— (center dashes) and ‘Z’, ‘O’, ‘U’ are overridden.</i>
<r>	range	(‘1’, ‘2’, ‘3’, etc.) always ‘1’ for single range
<n>	gross/net status	
	‘G’	G ross normal weight
	‘T’	T are weight (in response to ‘M’ command)
	‘N’	N et normal weight
	‘g’	g ross weight in high-resolution
	‘n’	n et weight in high-resolution
<m>	motion status	
	‘M’	scale in M otion
	<space>	scale not in M otion
<f>	future	reserved for future or custom use

<xxxxxxx.xxx> weight data this field is fixed at 10 characters

<uuu> Unit of Measure

<CR> End of response message

Examples:

Command	Response
<LF>W<CR>	<LF> <_> <1> <G> <_> <_> <_ _ _ _ 5.025> <lb_> <CR>
<LF>W<CR>	<LF> <_> <1> <N> <_> <_> <_ _ _ _ 100000> <lb_> <CR>
<LF>W<CR>	<LF> <_> <2> <G> <M> <_> <_ _ _ _ 8:08.5> <1/o> <CR>
<LF>H<CR>	<LF> <_> <1> <g> <_> <_> <_ _ _ _ 5.0025> <lb_> <CR>
<LF>Z<CR>	<LF> <Z> <1> <G> <_> <_> <_ _ _ _ 0.000> <lb_> <CR>
<LF>R<CR>	<LF> <_> <1> <G> <_> <_> <_ _ _ _ 7.025> <kg_> <CR> <LF> <_> <1> <G> <M> <_> <_ _ _ _ 7.650> <kg_> <CR> o o o <LF> <_> <1> <G> <_> <_> <_ _ _ _ 7.650> <kg_> <CR> <i>The scale will repeat weight until next command is received.</i>

5.2 Unrecognized Command Response

Any host command that the scale does not recognize either because it is not supported by the implemented SMA level or because it is simply not a recognized command will be responded to by the scale with an ASCII '?' question mark.

<LF> ? <CR>

5.3 Communication Error Response

Any host command that the scale does not recognize due to a communication error will be responded to by the scale with an ASCII '!' exclamation mark. This would include a parity error (if used), data framing error, or in the future a communication checksum error.

<LF> ! <CR>

5.4 Diagnostics Command Response

When the scale is commanded to perform internal diagnostics, after the test is performed the following response is returned with the appropriate error indicators set or cleared.

<LF> <r> <e> <c> <m> <CR>

where:

<LF>	Start of diagnostic response
<r>	'R' = RAM or ROM error, '_' = OK,
<e>	'E' = EEPROM error, '_' = OK
<c>	'C' = Calibration error, '_' = OK
<m>	Manufacturer specified, printable character, '_' = OK
<CR>	End of diagnostic message

Example: With no errors!

Command: <LF>D<CR>

Response: <LF> <_> <_> <_> <_> <CR>

5.5 About 'A' and 'B' Command Response

Response Format for 'About' commands A, B (variable length):

<LF><xxx>:<yyyyyy><CR>

where:

<LF>	Start of About response
<xxx>	About field descriptor is fixed at 3 characters, is left justified, filled with blanks on the right side.

Following fields are required:

“SMA” compliance level/revision
(response of 'A' command)

“MFG” manufacturer
(response of 1st 'B' command)

“MOD” product model identification
(response of 2nd 'B' command)

“REV” software revision as per manufacturer's method
(response of 3rd 'B' command)

The following are optional fields:

“SN_“ serial number

(response of 4th 'B' command)
"OP1" manufacturer specified optional field
(response of 5th 'B' command)

"OP2" manufacturer specified optional field
(response of 6th 'B' command)

"OPn" manufacturer specified optional field
(response of nth 'B' command)

"END" this is always the last About field
(response of the last 'B' command)

':' Separator between field name and field contents.

<yyyyyy> About fields contain 25 characters maximum.
Required fields see above, SN field may be empty (if not supplied)
SMA field contents <level/revision>
where: level= (1, 2, etc.); revision= (1.0, 1.1, etc.)

<CR> End of About response

Note: All required fields must be supplied, but are free format, printable characters, length is 25 characters maximum, and must not be empty with the exception of the serial number field. The 'A' command also must reset the scale's 'B' response pointer to the first valid item (i.e. 'MFG' string info).

Example:

Command	Response
<LF> A <CR>	<LF>SMA:1/1.0 <CR>
<LF> B <CR>	<LF>MFG:Weigh-Tronix, Corp. <CR>
<LF> B <CR>	<LF>MOD:7620 <CR>
<LF> B <CR>	<LF>REV:02-02 <CR>
<LF> B <CR>	<LF>SN_:1234567890U812 <CR>
<LF> B <CR>	<LF>END: <CR>

Note: if the host should ask for additional 'B' status then.

<LF> B <CR>	<LF> ? <CR>
-------------	-------------

5.6 Scale Information ‘I’ and ‘N’ Command Response

Response Format for Information commands ‘I’, ‘N’ (variable length):

<LF><xxx>:<yyyyyy><CR>

where: <LF> Start of Information response
<xxx> About field descriptor is fixed at 3 characters, is left justified, filled with blanks on the right side.

Following fields are required:

“SMA” compliance level/revision
(response of ‘I’ command)

“TYP” Scale type ‘S’= Scale or ‘C’= Classifier
(response 1st ‘N’ command)

“CAP” capacity of range, unit-of-measure, count-by and decimal position, each delimited by ‘:’

where: yyyyyy= uu:c..c:n:d

uu= unit-of-measure

c..c= full scale capacity of this range
(may include decimal point)

n= least significant count-by digit

(e.g. 1, 2, 5,10,20...) no decimal point

d= decimal point position ‘0’= none

‘1’= xxxx.x

‘2’= xxx.xx

‘3’= xx.xxx . . etc.

(response of 2nd ‘N’ command)

“CAP..n” capacity of any other multi-range multi-unit-of-measure, count-by and decimal position, each delimited by ‘:’

(response of 3rd..nth ‘N’ command)

“CMD” supported SMA commands, level #1 is assumed
see section 6.2 for the order of supported commands

there is no need to include the “IN” commands

(response of nth+ ‘N’ command)

“END” this is the last INformation field

(response of the last ‘N’ command)

‘:’ Separator between field name and field contents.

<yyyyyy> About fields contain 25 characters maximum.

All fields are required.

SMA field contents <level/revision>

where: level= (1, 2, etc.); revision= (1.0, 1.1, etc.)

<CR> End of Information response

Note: all required fields must be supplied, but are free format, printable characters, length is 25 characters maximum, and must not be empty with the exception of serial number field.

The 'I' command also must reset the scale's 'N' response pointer to the first valid item (i.e. 'TYP' string info).

Example 1: Single Range 120000lb x 20lb platform scale

Command	Response
<LF> I <CR>	<LF>SMA:2/1.0 <CR>
<LF>N<CR>	<LF>TYP:S <CR>
<LF>N<CR>	<LF>CAP:lb_:120000:20:0 <CR>
<LF>N<CR>	<LF>CMD:HTMC <CR>
<LF>N<CR>	<LF>END: <CR>

Example 2: Two Range Postal Weight Classifier

0-10lb x 0.05oz; 10-100lb 0.5oz

Command	Response
<LF> I <CR>	<LF>SMA:2/1.0 <CR>
<LF>N<CR>	<LF>TYP:C <CR>
<LF>N<CR>	<LF>CAP:l/o:10:5:2 <CR>
<LF>N<CR>	<LF>CAP:l/o:100:5:1 <CR>
<LF>N<CR>	<LF>CMD:HPQ <CR>
<LF>N<CR>	<LF>END: <CR>

Example 3: Two Range, dual unit-of-measure; Scale

0-10lb x 0.01lb; 10-70lb 0.05lb

0-5kg x .001kg; 5-30kg x .005kg

Command	Response
<LF> I <CR>	<LF>SMA:2/1.0 <CR>
<LF>N<CR>	<LF>TYP:S <CR>
<LF>N<CR>	<LF>CAP:lb_:10:1:2 <CR>
<LF>N<CR>	<LF>CAP:lb_:70:5:2 <CR>
<LF>N<CR>	<LF>CAP:kg_:5:1:3 <CR>
<LF>N<CR>	<LF>CAP:kg_:30:5:3 <CR>
<LF>N<CR>	<LF>CMD:HU <CR>
<LF>N<CR>	<LF>END: <CR>

5.7 Communication Error Handling

As stated earlier, this communication protocol has placed most of the burden of communication error handling on the host device. Putting this burden on the host was done expressly to make scale's firmware implementation as simple as possible. If a communication error is detected by the scale either through parity bit (optional) or a data framing error the scale will respond with an ASCII '!'. The only other error mechanism that has been incorporated into the scale is the unrecognized or unsupported command response message, in this case the scale responds with an ASCII '?'. Upon error discovery the host can then decide which course of action to take to re-affirm or re-establish proper communications with the scale.

Note: The Serial Communication Standard Committee also decided early on in the design (of this first standard) that scale response checksum error handling would not be a part of the first standard. The committee felt that that added complication was not warranted in this limited feature Scale Communication Standard. The addition of a checksum byte it will be addressed as a possible SMA #3...#n standard in a future meeting.

6.0 Compliance Levels

In this first attempt for a Scale Serial Communication Protocol Standard, the committee saw the need for two levels of serial communications. SMA Level #1 addresses the simplest of scale devices and SMA Level #2 is intended for scale devices that are more robust in processing power. The list below shows the commands available in these two levels of the standard.

Note: It is intended to have additional SMA Scale Communication Protocols in the future to address the variety of applications and needs of our industry. These additional protocols may either be added to this standard or a new standard may be generated depending on the compatibility of the new protocol to this document.

6.1 Level #1

Commands: W, Z, D, A, B, <ESC>

All devices must support these commands.

6.2 Level #2

In addition to the mandatory Level #1 commands, the following commands are also available.

Commands: H, P, Q, R, S, T, M, C, U, I, N, X

Any of these commands can be supported as fully as possible by the scale device. The scale device may respond with an unrecognized response or execute the command depending on the scale's capabilities. A scale will be considered SMA Level #2 compliant even if only one Level #2 Command is supported.

7.0 Approved Units of Measure Abbreviations:

“uuu”	Unit of Measure
“ooo”	free choice unit or custom units (user specifies 1-3 characters)
“lb_”	Pounds
“oz_”	Ounces
“l/o”	lb/oz
“kg_”	Kilograms
“g_”	Grams
“ozt”	Troy Ounces
“ct_”	Carats
“tlh”	Hong Kong Taels
“tls”	Singapore Taels
“tlt”	Taiwanese Taels
“gn_”	Grains
“dwt”	Pennyweights
“mg_”	Milligrams
“/lb”	Parts per pound
“tlc”	Chinese Taels
“mom”	Mommies
“k_”	Austrian Carats
“tol”	Tola
“bat”	Bath
“ms_”	Mesghal
“t_”	Metric ton
“ton”	avoir ton
“ug_”	microgram (preferred as a Greek “mu” symbol + “g”)
“tl_”	tael (nonspecific)
“%_”	Percent
“_”	no units (3 Spaces)

Annex A (Normative Content)

No Normative Information (part of the standard)

Annex B (Informative Content)

Contributors to this Standard:

George Brazis – Weigh-Tronix, Inc. (Chairperson)

Bill Belknap – NCR Corporation

Doug Bliss – Mettler-Toledo, Inc.

Larry Hicks – Cardinal Scale Mfg. Company

Dennis Krueger – NCR Corporation

David Miller – Hobart Corporation

Bob Regis – Fairbanks Scale

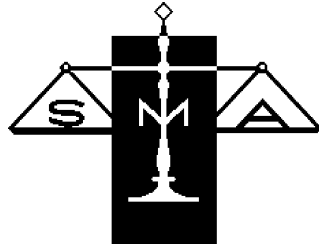
Uwe Ross – Sartorius Corporation

Jerry Wang – A&D Weighing

Possible Next Scale Communication Tasks:

- PC Based Communication Standard Conformance Tester
- Enhanced Error Handling in current protocol (Parity and Checksum)
- Enhanced application specific protocols (indicator, counting, price computing, etc.)
- NCR OPOS Driver for current standard
- RS-422/485 Multi-drop protocol
- USB version
- CAN version

Other protocols as required



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**SCALE MANUFACTURERS ASSOCIATION
(SMA)**

6724 Lone Oak Blvd.
Naples, Florida 34109
Tel: (239) 514-3441
Fax: (239) 514-3470

E-Mail: sma@scalemanufacturers.org
Web Site: <http://www.scalemanufacturers.org>