HENGSTLER

# Supplementary Operation Instructions **tico 735**

## Protocol of Communication Interface of the Product Family **tico 735**


This manual describes the protocol of the serial comms interface and applies for the following products:

- **0735P**XXX**5**X (Counters, Rate Meters etc.)
- **0735A**XXX**5**X (Process Indicators)

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## Physical Protocol

A standard RS485 link is used. Up to 32 standard RS485 loads may be presented to a single loop on this link. Since Awesome products present 0.25 standard load each, a maximum of 128 may be connected to a single loop (ignoring the load presented by the Master device)

Bit-stream settings are: 1 start bit, 7 data bits, even parity, 1 stop bit. (10 bit word).

Baud Rates Supported are: 1200, 2400, 4800, 9600

Half-duplex line turn-round time fixed at 6 ms regardless of Baud Rate.
Maximum inter-character delay 120 ms.
No-reply timeout period 2 seconds.

## Software Protocol

The protocol operates on a single master basis only.

### Addressing

Comms addressing is from 1 to 99.
Write operations only can be broadcast using address 0 as the comms address. In this case, the receiving units will attempt to implement the write operation but will not reply.

### Message Framing

Message framing is implemented with a start of message character (L) and a terminating character (*)

### Positive and Negative Acknowlegements

A reply will carry either a positive or negative acknowledgement. This is given by the character immediately preceding the message terminator.

A positive acknowledgement is signalled by the letter A in this position.
A negative acknowledgement is signalled by the letter N in this position.

### Legal Parameter ID Ranges

For the Digital variants, the permitted range of parameters IDs is:

A to K,
M to U,
a to |,
?
!

For the Analogue variants, the permitted range of parameter IDs is:

: to K,
M to ^,
a to p
?
!

## Software Protocol - Error Actions

If a slave device detects a syntax error or parity error, it will not reply to the message, and the master should retry up to two times, applying the no reply timeout of 2 seconds in each case.
Read operations on parameters with identifiers within the legal range which are not supported by a given instrument will always return values of zero, and will generate a positive acknowledgement.

Write operations on parameters with identifiers within the legal range which are not supported by a given instrument will have no effect on any functional values, and will generate a positive acknowledgement.

Read or write operations on parameter identifiers which fall outside the legal range will be treated as syntax errors, and will generate no reply.

Attempts to write illegal values to parameters will generate a negative acknowledgement.

## Data Format

Data is expressed as a five digit signed hexadecimal number. The following characters are permitted as elements in the data string:

```
0 1 2 3 4 5 6 7 8 9 A B C D E F
```

Example: Parameter value 57409 → data string: „0E041“
Example: Parameter valuet –19999 → data string: „FB1E1“

Note that the non-numeric characters are all upper case. Any other characters will be treated as a syntax error.

Where a value carries a decimal point, the point position is implicit, and the responsibility for interpreting it lies with the user.

### *Address Bytes*

The address of a tico 735 is between 1 and 99 and can be generated as follows:

Examples:

| Address decimal 9 | |
|---|---|
| Address Hi Byte | Address Lo Byte |
| 0 | 9 |

| Address decimal 15 | |
|---|---|
| Address Hi Byte | Address Lo Byte |
| 0 | E |

| Address decimal 44 | |
|---|---|
| Address Hi Byte | Address Lo Byte |
| 2 | C |

| Address decimal 99 | |
|---|---|
| Address Hi Byte | Address Lo Byte |
| 6 | 3 |

In BASIC this can be done as follows:

```
INPUT adr                                          'adr = adresse in ASCII
    adr$ = HEX$(adr)                               'adress as string (in hex)
    IF LEN(adr$) = 1 THEN adr$ = "0" + adr$
form2request$ = "L" + adr$ + ParamID$ + "*"        ' Form2 message
```

## Message Formats

There are three message formats, which permit:

1. instrument identification
2. parameter read operations
3. parameter write operations

## Form 1 Messages

This message functions as an instrument identification format. The Master device sends a Form 1 message to ascertain whether a given comms address is occupied by an instrument. If it is, the reply will be received. If there is no reply, either the address is not occupied or there is a comms link failure.

**Message Sent**

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Query Message | End Char |
|---|---|---|---|---|---|
| L | a | a | ? | ? | * |

where: aa is a two-digit hex. number signifying the comms address

**Reply**

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Positive Ack. | End Char |
|---|---|---|---|---|---|
| L | a | a | ? | A | * |

where: aa is a two-digit hex. number echoing the message sent

## Form 2 Messages

This message format implements the parameter read operation.

**Message Sent**

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Query Message | End Char |
|---|---|---|---|---|---|
| L | A | a | p | ? | * |

where: aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below

**Reply**

Where the parameter queried exists on a given instrument variant, the reply is of the following form:

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Data Value | | | | | Positive Ack. | End Char |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | P | n | n | n | n | n | A | * |

where: aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below
nnnnn is a five-digit hex. number signifying the data value

Where the parameter queried does not exist on a particular instrument variant, the reply is as follows:

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Dummy Data Value | | | | | Positive Ack. | End Char |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | 0 | 0 | 0 | 0 | 0 | A | * |

where: aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below
00000 is five zeroes

### *Data Bytes*

The 5 data bytes are returned by the tico 735 in a HEX format. The following conditions apply:

- first byte is „0“ or „1“ → value is positiv
- first byte is „F“ → value is negative

Examples:

| Start character | Address Hi byte | Address Lo byte | Param. ID | data bytes in HEX | | | | | valid character | end character |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | 1 | 8 | 6 | 9 | F | A | * |
| | | | | data value in decimal | | | | | | |
| | | | | 9 | 9 | 9 | 9 | 9 | | |

| Start character | Address Hi byte | Address Lo byte | Param. ID | data bytes in HEX | | | | | valid character | end character |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | 0 | F | 3 | A | E | A | * |
| | | | | data value in decimal | | | | | | |
| | | | | 6 | 2 | 3 | 8 | 2 | | |

| Start character | Address Hi byte | Address Lo byte | Param. ID | data bytes in HEX | | | | | valid character | end character |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | F | B | 1 | E | 1 | A | * |
| | | | | data value in decimal | | | | | | |
| | | | | -1 | 9 | 9 | 9 | 9 | | |

In BASIC the data bytes can be converted to decimal as follows:

The interface receives the 5-character string **answer$**.

```
data$ = MID$(answer$, 5, 5)                        'isolate 5 characters
SELECT CASE LEFT$(data$, 1)
    CASE "0" TO "1"                                'positiv value if 0 or 1
                                                   'convert to decimal
        dez = VAL("&H" + MID$(data$, 3, 3))
        dez = dez + VAL("&H" + MID$(data$, 2, 1)) * 16 ^ 3
        dez = dez + VAL("&H" + MID$(data$, 1, 1)) * 16 ^ 4

    CASE "F"                                       'negative value if F
        deci = VAL("&H" + RIGHT$(data$, 4))         'rightmost 4 characters
                                                   'form the negative value
END SELECT
```

**deci** contains the decimal value.

## Form 3 Messages

This format implements the single-unit write operation. Multiple units may be written to using the Broadcast Write to Address 00, which has the same format for the Message Sent, but requires that the slave unit generates no reply.

**Message Sent**

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Data Value | | | | | End Char |
|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | n | n | n | n | n | * |

where:

aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below
nnnnn is a five-digit hex. number signifying the data value to be written

**Reply**

Where the parameter queried exists on a given instrument variant and the value contained in the message sent is legal or the parameter does not exist, the reply is of the following form:

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Data Value | | | | | Positive Ack. | End Char |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | n | n | n | n | n | A | * |

where:

aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below
nnnnn is a five-digit hex. number signifying the data value written. In cases where the parameter does not exist this value will always be 00000.

Where the parameter queried exists on a given instrument variant and the value contained in the message sent is illegal, the reply is of the following form:

| Start Char | Address High Byte | Address Low Byte | Parameter ID | Data Value | | | | | Negative Ack. | End Char |
|---|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | n | n | n | n | n | N | * |

where:

aa is a two-digit hex. number signifying the comms address
p is a single character Parameter Identifier as detailed in Tables 1 and 2 below
nnnnn is a five-digit hex. number signifying the error condition as follows:

| Value | Error Condition |
|---|---|
| FFFFF | UNDERRANGE |
| 7FFFF | OVERRANGE |
| 7FFFE | SENSOR BREAK |
| 00001 | READ ONLY PARAMETER |
| 00000 | ILLEGAL VALUE |

### *Create Data String for Write Operation*

The numeric value of your application is sent as a 5-character HEX string to the tico 735. Also watch for negative and positive values.

Example:
**Form 3 message (value is sent to tico 735):**

| Start character | Adress Hi Byte | Adress Lo Byte | Param. ID | Data Bytes HEX | | | | | End character |
|---|---|---|---|---|---|---|---|---|---|
| L | a | a | p | 1 | 8 | 6 | 9 | F | * |
| | | | | decimal Data value | | | | | |
| | | | | 9 | 9 | 9 | 9 | 9 | |

Converting with BASIC:

```
LOCATE zeile, 1: INPUT eingabe$
    IF eingabe$ = "" THEN END

numwert = VAL(eingabe$)
dummy$ = HEX$(numwert)

IF LEN(dummy$) = 8 THEN
    daten$ = RIGHT$(dummy$, 5)
ELSEIF LEN(dummy$) < 8 THEN
    daten$ = RIGHT$("00000", 5 - LEN(dummy$)) + dummy$
ELSEIF eingabe$ = "?" THEN
    daten$ = eingabe$
END IF

form3message$ = "L" + adr$ + ParamID$ + data$ + "*"
```

## Table 1. Digital Units - Complete Parameter List

| Parameter ID (Code) | Totalizer | Position Indicator | 1 Preset Counter | 2 Preset Counter | Batch Counter | Rate meter | Rater Meter + Totalizer | Elapsed Timer |
|---|---|---|---|---|---|---|---|---|
| **READ ONLY** | | | | | | | | |
| **?** (3FH) | Form 1 Command Identifier | | | | | | | |
| **A** (41H) | Count | | Count | Count | Count | | Count | |
| **B** (42H) | | | | | | Rate Value | Rate Value | |
| **C** (43H) | | Position | | | | | | |
| **D** (44H) | | | | | | | | Time Value |
| **E** (45H) | | | | | | Process Time | | |
| **F** (46H) | | | | | Background Total | | | |
| **G** (47H) | | | | | Batch Value | | | |
| **READ/WRITE (NOT PROGRAM MODE)** | | | | | | | | |
| **H** (48H) | Reset Count | Reset Pos'n | Reset Count | Reset Count | Reset Count | | Reset Count | |
| **I** (49H) | | | | | | | | Reset Time |
| **J** (4AH) | | | | | Reset Background Count | | | |
| **K** (4BH) | | | | | Reset Batch Count | | | |
| **L** (4CH) | (Reserved for Message Start Character) | | | | | | | |
| **M** (4DH) | | | | | Batch Preset | | | |
| **N** (4EH) | Preset | | Preset | Preset 1 | Preset | | | |
| **O** (4FH) | | | | Preset 2 | | | | |
| **P** (50H) | | | | | | | | Set Value |
| **Q** (51H) | | | | Pre-Warn | | | | |
| **R** (52H) | | High Alarm Value | | | | High Alarm Value | High Alarm Value | |
| **S** (53H) | | Low Alarm Value | | | | Low Alarm Value | Low Alarm Value | |
| **T** (54H) | Enter Program Mode | Enter Program Mode | Enter Program Mode | Enter Program Mode | Enter Program Mode | Enter Program Mode | Enter Program Mode | Enter Program Mode |
| **U** (55H) | Exit Program Mode | Exit Program Mode | Exit Program Mode | Exit Program Mode | Exit Program Mode | Exit Program Mode | Exit Program Mode | Exit Program Mode |
| **READ/WRITE (PROGRAM MODE)** | | | | | | | | |
| **a** (61H) | | | | | | Rate Cal.Factor | Rate Cal.Factor | |
| **b** (62H) | | | | | | Rate Cal.Factor D.P. | Rate Cal.Factor DP | |
| **c** (63H) | | | | | | D.P.Position | DP Position (Rate ) | |
| **d** (64H) | Cal. Factor | Cal.Factor | Cal.Factor | Cal. Factor | Cal. Factor | | Count Cal.Factor | |
| **e** (65H) | D.P.Position | D.P.Position | D.P.Position | D.P. Position | D.P. Position | | D.P.Position (Count) | |
| **f** (66H) | | Reset Value | | | | | | |
| **g** (67H) | Count Mode | | Count Mode | Count Mode | Count Mode | | Count Mode | |
| **h** (68H) | | | | | | Rate Mode | | |
| **i** (69H) | | | | Preset Mode | | | | |
| **j** (6AH) | | | Count Direction | Count Direction | Count Direction | | | |
| **k** (6BH) | Input Type | | Input Type | Input Type | Input Type | Input Type | Input Type | Input Type |

| Parameter ID | Totalizer | Position Indicator | 1 Preset Counter | 2 Preset Counter | Batch Counter | Rate meter | Rater Meter + Totalizer | Elapsed Timer |
|---|---|---|---|---|---|---|---|---|
| l (6Ch) | Filter Speed | Filter Speed | Filter Speed | Filter Speed | Filter Speed | Filter Speed | Filter Speed | |
| m (6DH) | | | | | | Display Update Time | Display Update Time | |
| n (6EH) | | | | | | Display to Zero Time | Display to Zero Time | |
| o (6FH) | | | | | | Minimum Pulses | Minimum Pulses | |
| p (70H) | | | | | | Startup Suppression | Startup Suppression | |
| q (71H) | | | Output Time 1 | Output Time 1 | Output Time 1 | | | |
| r (72H) | | | | Output Time 2 | Output Time 2 | | | |
| s (73H) | F.P. Reset | F.P.Reset | F.P.Reset | F.P.Reset | F.P.Reset | | | F.P.Reset |
| t (74H) | | Retransmit | | | | Retransmit | Retransmit | |
| u (75H) | | Retrans. Scale Min | | | | Retrans. Scale Min | Retrans. Scale Min | |
| v (76H) | | Retrans. Scale Max | | | | Retrans. Scale Max | Retrans. Scale Max | |
| w (77H) | Colour | Colour | Colour | Colour | Colour | Colour | Colour | Colour |
| x (78H) | Preset Lock | Preset Lock | Preset Lock | Preset Lock | Preset Lock | Preset Lock | Preset Lock | Preset Lock |
| y (79H) | | | | | | | | Function |
| z (7AH) | | | | | | | | Time Format |
| { (7BH) | | | | | | | | Timing Direction |
| \| (7CH) | Help Level | Help Level | Help Level | Help Level | Help Level | Help Level | Help Level | Help Level |

## Digital Units - Detailed Command Summary

***Count Value*** ..... ***A***

R/O. Legal range: 0 to 99999.

***Rate Value*** ..... ***B***

R/O. Legal range: 0 to 99999.

***Position Value*** ..... ***C***

R/O. Legal range: -19999 to 99999

***Time Value*** ..... ***D***

R/O. Legal range: 0 to 99999

***Process Time Value*** ..... ***E***

R/O. Legal range: 0 to 99999

***Background Total Value*** ..... ***F***

R/O. Legal range: 0 to 99999

***Batch Value*** ..... ***G***

R/O. Legal range: 0 to 99999

***Reset Count*** ..... ***H***

R/W. Writing any value will reset the Count on all counters & the Rate + Totalizer. Reading will always return 0.

***Reset Time*** ..... ***I***

R/W. Writing any value will reset the Time on the Elapsed Timer. Reading will always return 0.

***Reset Background*** ***J***

R/W. Writing any value will reset the Background Count on Rate + Totalizer. Reading will always return 0.

***Reset Batch*** ***K***

R/W. Writing any value will reset the Batch Value on Rate + Totalizer. Reading will always return 0.

***Batch Preset*** ***M***

R/W. Legal range: 0 to 99999

***Preset (1)*** ***N***

R/W. Legal range: 0 to 99999

***Preset 2*** ***O***

R/W. Legal range: 0 to 99999

***Set Value*** ***P***

R/W. Legal range: 0 to 99999

***Pre-Warn Value*** ***Q***

R/W. Legal range: 0 to 99999

***High Alarm Value*** ***R***

R/W. Legal range: 0 to 99999, except for Position Indicator (-19999 to 99999)

***Low Alarm Value*** ***S***

R/W. Legal range: 0 to 99999, except for Position Indicator (-19999 to 99999)

***Enter Program Mode*** ***T***

R/W. Legal range - read: 0 or 1, write: 1.
This parameter will return 0 if the instrument is not in Program Mode, or 1 if it is.
In response to a write operation with a data value of 1, the instrument will enter Program Mode, and the Program Mode parameters will become writable until such time as the Exit Program Mode command is written to with a value of 1. While in Program Mode, the instrument will not respond to any inputs and no outputs will activate.
The status of Program Mode does not persist on power-down.

***Exit Program Mode*** ***U***

R/W. Legal range - read: 0 or 1, write: 1.
This parameter will return 0 if the instrument is in Program Mode, or 1 if it is not.
In response to a write operation with a data value of 1, the instrument will leave Program Mode, and the Program Mode parameters will resume their normal Read Only status. The instrument will respond to inputs and activate outputs as normal.

***Rate Cal Factor Value*** ***a***

R/O if not in Program Mode, otherwise R/W. Legal range: 1 to 99999

***Rate Cal Factor Decimal Point Position*** ***b***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 4, signifying the number of digits to the right of the decimal point.

***Rate Decimal Point Position*** ***c***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 4, signifying the number of digits to the right of the decimal point.

***Count Cal Factor*** ***d***

R/O if not in Program Mode, otherwise R/W. Legal range: 1 to 99999

***Count Decimal Point Position*** ***e***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 4, signifying the number of digits to the right of the decimal point.

***Reset Value*** ***f***

R/O if not in Program Mode, otherwise R/W. Legal range: -19999 to 99999.

***Count Mode*** ***g***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 3 signifying A+B, A-B, Directional or Quadrature respectively.

***Rate Mode*** ***h***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 2 signifying A, A/B, A Process Time modes respectively.

***Preset Mode*** ***i***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying Preset 1 or Pre-Warn respectively.

***Count Direction*** ***j***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 3 signifying Up, Down, Up+AutoReset and Down+AutoReset respectively.

***Input Type*** ***k***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying Source or Sink respectively. Rate Meters will accept value of 0 to 2, signifying Source, Sink or Magnetic Input respectively.

***Filter Speed*** ***l***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 2, signifying 20, 200 or 10,000 respectively.

***Display Update Time*** ***m***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 12 as follows:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Comms value | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Instrument value | 0.1 | 0.25 | 0.5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

***Display to Zero Time*** ***n***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 12 as follows:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Comms value | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Instrument value | 0.1 | 0.25 | 0.5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

***Minimum Pulses*** ***o***

R/O if not in Program Mode, otherwise R/W. Legal range: 1 to 99.

***Startup Suppression*** ***p***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 99.

***Output Time 1*** ***q***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 9999. Fixed decimal point positon of 2.

***Output Time 2*** ***r***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 9999. Fixed decimal point positon of 2.

***Front Panel Reset Disable*** ***s***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying enabled and disabled respectively.

***Retransmit Select*** ***t***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 6 signifying None, 0-5V, 1-5V, 0-10V, 2-10V, 0-20mA and 4-20mA respectively.

***Retransmit Scale Minimum*** ***u***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 99999. Position Indicator accepts values of -19999 to 99999.

***Retransmit Scale Maximum*** ***v***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 99999. Position Indicator accepts values of -19999 to 99999.

***Colour Setting*** ..... ***w***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 3, signifying Red, Green, Green/Red and Red/Green respectively.

***Preset Lock Disable*** ..... ***x***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying enabled and disabled respectively.

***Function*** ..... ***y***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying Cumulative or Single Shot timing respectively.

***Time Format*** ..... ***z***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 4, signifying Seconds, Minutes, Hours, Minutes : Seconds and Hours : Minutes respectively.

***Timing Direction*** ..... ***{***

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying Up or Down.

***Help Level Disable*** ..... |

R/O if not in Program Mode, otherwise R/W. Legal range: 0 to 1, signifying Enabled or Disabled.

## Table 2. Analogue Units - Complete Parameter List

| Parameter ID | DC Process | Temperature | AC Volts/Amps | DC Volts/Amps | Strain Gauge |
|---|---|---|---|---|---|
| **READ ONLY** | | | | | |
| : (3AH) | Process Variable | Process Variable | Process Variable | Process Variable | Process Variable |
| ; (3BH) | Total | | | | Total |
| < (3CH) | Max PV | Max PV | Max PV | Max PV | Max PV |
| = (3DH) | Min PV | Min PV | Min PV | Min PV | Min PV |
| > (3EH) | Elapsed Time | Elapsed Time | Elapsed Time | Elapsed Time | Elapsed Time |
| ? (3FH) | Form 1 Command Identifier | | | | |
| **READ/WRITE** | | | | | |
| @ (40H) | Reset Max PV | Reset Max PV | Reset Max PV | Reset Max PV | Reset Max PV |
| A (41H) | Reset Min PV | Reset Min PV | Reset Min PV | Reset Min PV | Reset Min PV |
| B (42H) | Reset Elapsed Time | Reset Elapsed Time | Reset Elapsed Time | Reset Elapsed Time | Reset Elapsed Time |
| C (43H) | Reset Total | | | | Reset Total |
| D (44H) | Reset Alarm 1 | Reset Alarm 1 | Reset Alarm 1 | Reset Alarm 1 | Reset Alarm 1 |
| E (45H) | Alarm 1 Value | Alarm 1 Value | Alarm 1 Value | Alarm 1 Value | Alarm 1 Value |
| F (46H) | Alarm 2 Value | Alarm 2 Value | Alarm 2 Value | Alarm 2 Value | Alarm 2 Value |
| G (47H) | Scaling point 1 | | Scaling point 1 | Scaling point 1 | Scaling point 1 |
| H (48H) | Display point 1 | | Display point 1 | Display point 1 | Display point 1 |
| I (49H) | Scaling point 2 | | Scaling point 2 | Scaling point 2 | Scaling point 2 |
| J (4AH) | Display point 2 | | Display point 2 | Display point 2 | Display point 2 |
| K (4BH) | Scaling point 3 | | Scaling point 3 | Scaling point 3 | Scaling point 3 |
| L (4CH) | (Reserved for Message Start Character) | | | | |
| M (4DH) | Display point 3 | | Display point 3 | Display point 3 | Display point 3 |
| N (4EH) | Scaling point 4 | | Scaling point 4 | Scaling point 4 | Scaling point 4 |
| O (4FH) | Display point 4 | | Display point 4 | Display point 4 | Display point 4 |
| P (50H) | Scaling point 5 | | Scaling point 5 | Scaling point 5 | Scaling point 5 |
| Q (51H) | Display point 5 | | Display point 5 | Display point 5 | Display point 5 |
| R (52H) | Scaling point 6 | | Scaling point 6 | Scaling point 6 | Scaling point 6 |
| S (53H) | Display point 6 | | Display point 6 | Display point 6 | Display point 6 |
| T (54H) | Scaling point 7 | | Scaling point 7 | Scaling point 7 | Scaling point 7 |
| U (55H) | Display point 7 | | Display point 7 | Display point 7 | Display point 7 |
| V (56H) | Scaling point 8 | | Scaling point 8 | Scaling point 8 | Scaling point 8 |
| W (57H) | Display point 8 | | Display point 8 | Display point 8 | Display point 8 |
| X (58H) | Scaling point 9 | | Scaling point 9 | Scaling point 9 | Scaling point 9 |
| Y (59H) | Display point 9 | | Display point 9 | Display point 9 | Display point 9 |
| Z (5AH) | Scaling point 10 | | Scaling point 10 | Scaling point 10 | Scaling point 10 |
| [ (5BH) | Display point 10 | | Display point 10 | Display point 10 | Display point 10 |
| \ (5CH) | Decimal Point Pos. | | Decimal Point Pos. | Decimal Point Pos. | Decimal Point Pos. |
| ] (5DH) | Retrans Scale min | Retrans Scale min | Retrans Scale min | Retrans Scale min | Retrans Scale min |
| ^ (5EH) | Retrans Scale max | Retrans Scale max | Retrans Scale max | Retrans Scale max | Retrans Scale max |
| _ (5FH) | PV Offset | PV Offset | PV Offset | PV Offset | PV Offset |
| ` (60H) | PV Filter | PV Filter | PV Filter | PV Filter | PV Filter |
| a (61H) | Colour | Colour | Colour | Colour | Colour |
| b (62H) | Alarm Lock | Alarm Lock | Alarm Lock | Alarm Lock | Alarm Lock |
| c (63H) | Help Level | Help Level | Help Level | Help Level | Help Level |
| d (64H) | Enter Config Mode | Enter Config Mode | Enter Config Mode | Enter Config Mode | Enter Config Mode |
| **READ/WRITE (CONFIG MODE)** | | | | | |
| e (65H) | Exit Config Mode | Exit Config Mode | Exit Config Mode | Exit Config Mode | Exit Config Mode |
| f (66H) | Input Type | Input Type | Input Type | Input Type | |
| g (67H) | | Range Trim Max | | | |
| h (68H) | | Range Trim Min | | | |
| i (69H) | Mains Frequency | Mains Frequency | Mains Frequency | Mains Frequency | Mains Frequency |
| j (6AH) | Alarm 1 Type | Alarm 1 Type | Alarm 1 Type | Alarm 1 Type | Alarm 1 Type |
| k (6BH) | Alarm 2 Type | Alarm 2 Type | Alarm 2 Type | Alarm 2 Type | Alarm 2 Type |
| l (6CH) | Output 1 Use | Output 1 Use | Output 1 Use | Output 1 Use | Output 1 Use |
| m (6DH) | Output 2 Use | Output 2 Use | Output 2 Use | Output 2 Use | Output 2 Use |
| n (6FH) | Retrans Select | Retrans Select | Retrans Select | Retrans Select | Retrans Select |
| o (70H) | Total Scale Factor | | | | Total Scale Factor |
| p (71H) | | | | | Gauge PSU Select |

## Analogue Units - Detailed Command Summary

***Process Variable*** ..... ***:***
R/O. Legal range: -19999 to 99999

***Total Value*** ..... ***;***
R/O. Legal range: -19999 to 99999

***Maximum PV*** ..... <
R/O. Legal range: -19999 to 99999

***Minimum PV*** ..... =
R/O. Legal range: -19999 to 99999

***Elapsed Time*** ..... >
R/O. Legal range: 0 to 99999

***Reset Max PV*** ..... ***@***
R/W. Writing any value will reset the Max PV. Reading will always return 0.

***Reset Min PV*** ..... ***A***
R/W. Writing any value will reset the Min PV. Reading will always return 0.

***Reset Elapsed Time*** ..... ***B***
R/W. Writing any value will reset the Elapsed Time. Reading will always return 0.

***Reset Total*** ..... ***C***
R/W. Writing any value will reset the Max PV. Reading will always return 0.

***Reset Latched Alarm 1*** ..... ***D***
R/W. Writing any value will reset the Max PV. Reading will always return 0.

***Alarm 1 Value*** ..... ***E***
R/W. Legal range: Range max to range min.

***Alarm 2 Value*** ..... ***F***
R/W. Legal range: Range max to range min.

***Scaling Point 1*** ..... ***G***
R/W. Legal range: 0 to 100.00

***Display Point 1*** ..... ***H***
R/W. Legal range: -19999 to 99999

***Scaling Point 2*** ..... ***I***
R/W. Legal range: Scale point 1 to 100.00

***Display Point 2*** ..... ***J***
R/W. Legal range: Display point 1 to 99999

***Scaling Point 3*** ..... ***K***
R/W. Legal range: Scale point 2 to 100.00

***Display Point 3*** ..... ***M***
R/W. Legal range: Display point 2 to 99999

***Scaling Point 4*** ..... ***N***
R/W. Legal range: Scale point 3 to 100.00

***Display Point 4*** ..... ***O***

R/W. Legal range: Display point 3 to 99999

***Scaling Point 5*** ..... ***P***

R/W. Legal range: Scale point 4 to 100.00

***Display Point 5*** ..... ***Q***

R/W. Legal range: Display point 4 to 99999

***Scaling Point 6*** ..... ***R***

R/W. Legal range: Scale point 5 to 100.00

***Display Point 6*** ..... ***S***

R/W. Legal range: Display point 5 to 99999

***Scaling Point 7*** ..... ***T***

R/W. Legal range: Scale point 6 to 100.00

***Display Point 7*** ..... ***U***

R/W. Legal range: Display point 6 to 99999

***Scaling Point 8*** ..... ***V***

R/W. Legal range: Scale point 7 to 100.00

***Display Point 8*** ..... ***W***

R/W. Legal range: Display point 7 to 99999

***Scaling Point 9*** ..... ***X***

R/W. Legal range: Scale point 8 to 100.00

***Display Point 9*** ..... ***Y***

R/W. Legal range: Display point 8 to 99999

***Scaling Point 10*** ..... ***Z***

R/W. Legal range: Scale point 9 to 100.00

***Display Point 10*** ..... ***[***

R/W. Legal range: Display point 9 to 99999

***Decimal Point Position*** ..... \

R/W. Legal range: 0 to 4.

***Re-Tranmsit Scale Min*** ..... ***]***

R/W. Legal range: -19999 to Retrans scale max.

***Re-Tranmsit Scale Max*** ..... ^

R/W. Legal range: Retrans scale min to 99999.

***PV Offset*** ..... _

R/W. Legal range: 0 to Range span.

***PV Filter*** ..... ***‘***

R/W. Legal range: 0 to 1000 signifying 0.0 to 100.0s. Note that this is only settable in 0.5s increments - values that are not divisible by 5 will return an error.

***Colour Setting*** ..... ***a***

R/W. Legal range: 0 to 3, signifying Red, Green, Green/Red and Red/Green respectively.

***Alarm Lock Disable*** ..... ***b***

R/W. Legal range: 0 to 1, signifying enabled and disabled respectively.

### *Help Level Disable* ..... *c*

R/W. Legal range: 0 to 1, signifying Enabled or Disabled.

### *Enter Config Mode* ..... *d*

R/W. Legal range - read: 0 or 1, write: 1.
This parameter will return 0 if the instrument is not in Config Mode, or 1 if it is.
In response to a write operation with a data value of 1, the instrument will enter Config Mode, and the Config Mode parameters will become writable until such time as the Exit Config Mode command is written to with a value of 1.
The status of Config Mode does not persist on power-down.

### *Exit Config Mode* ..... *e*

R/W. Legal range - read: 0 or 1, write: 1.
This parameter will return 0 if the instrument is in Config Mode, or 1 if it is not.
In response to a write operation with a data value of 1, the instrument will leave Config Mode, and the Config Mode parameters will resume their normal Read Only status.

### *Input Type* ..... *f*

R/O if not in Config mode, otherwise R/W. Legal range and effect according to instrument as follows...

| ***TEMPERATURE*** | | | | | |
|---|---|---|---|---|---|
| Comms value | Range Identifier | Range | Comms value | Range Identifier | Range |
| 0H | 100 | J type -200øC - 1200øC | 0EH | 500 | B type 100øC - 1824øC |
| 1H | 101 | J type -328øF - 2192øF | 0FH | 501 | B type 212øF - 3315øF |
| 2H | 110 | J type -128øC - 537øC | 10H | 600 | R type 0øC - 1760øC |
| 3H | 111 | J type -198.4øF - 998.6øF | 11H | 601 | R type 32øF - 3200øF |
| 4H | 200 | T type -240øC - 400øC | 12H | 700 | S type 0øC - 1760øC |
| 5H | 201 | T type -400øF - 752øF | 13H | 701 | S type 32øF - 3200øF |
| 6H | 210 | T type -128øC - 400øC | 14H | 800 | RTD -200øC - 800øC (3-Wire) |
| 7H | 211 | T type -198.4øF - 752.0øF | 15H | 801 | RTD -328øF - 1472øF (3-Wire) |
| 8H | 300 | K type -240øC - 1372øC | 16H | 810 | RTD -128øC - 537øC (3-Wire) |
| 9H | 301 | K type -400øF - 2502øF | 17H | 811 | RTD -198.4øF - 998.6øF (3-Wire) |
| 0AH | 310 | K type -128øC - 537øC | 18H | 900 | RTD -200øC - 800øC (4-Wire) |
| 0BH | 311 | K type -198.4øF - 998.6øF | 19H | 901 | RTD -328øF - 1472øF (4-Wire) |
| 0CH | 400 | N type 0øC - 1399øC | 1AH | 910 | RTD -128øC - 537øC (4-Wire) |
| 0DH | 401 | N type -32øF - 2550øF | 1BH | 911 | RTD -198.4øF - 998.6øF (4-Wire) |

| ***DC PROCESS*** | | | ***AC VOLTS / AMPS*** | | | ***DC VOLTS / AMPS*** | | |
|---|---|---|---|---|---|---|---|---|
| Comms value | Range Identifier | Range | Comms value | Range Identifier | Range | Comms value | Range Identifier | Range |
| 1CH | 2200 | 0-20mA | 26H | 3000 | 0-1V | 2EH | 2800 | 0-100mV |
| 1DH | 2300 | 4-20mA | 27H | 3400 | 0-10V | 2FH | 3000 | 0-1V |
| 1EH | 2400 | 10-50mA | 28H | 3700 | 0-100V | 30H | 3400 | 0-10V |
| 1FH | 3200 | 0-5V | 29H | 3800 | 0-600V | 31H | 3700 | 0-100V |
| 20H | 3300 | 1-5V | 2AH | 2000 | 0-1mA | 32H | 3800 | 0-600V |
| 21H | 3400 | 0-10V | 2BH | 2100 | 0-10mA | 33H | 2000 | 0-1mA |
| 22H | 3500 | 2-10V | 2CH | 2500 | 0-100mA | 34H | 2100 | 0-10mA |
| 23H | 2900 | +/-100mV | 2DH | 2600 | 0-1A | 35H | 2500 | 0-100mA |
| 24H | 3100 | +/-1V | | | | 36H | 2600 | 0-1A |
| 25H | 3600 | +/-10V | | | | 37H | 2700 | 0-2A |

### *Range Trim Max* ..... *g*

R/O if not in Config mode, otherwise R/W. Legal range: Range trim min to Range max.

### *Range Trim Min* ..... *h*

R/O if not in Config mode, otherwise R/W. Legal range: Range min to Range trim max.

***Mains Frequency*** ***i***

R/O if not in Config mode, otherwise R/W. Legal range: 0 or 1 signifying 50Hz or 60Hz respectively. Note that this parameter is only effective on DC powered instruments.

***Alarm 1 Type*** ***j***

R/O if not in Config mode, otherwise R/W. Legal range: 0 to 2 signifying nonE, P_Hi, P_Lo respectively.

***Alarm 2 Type*** ***k***

R/O if not in Config mode, otherwise R/W. Legal range: 0 to 2 signifying nonE, P_Hi, P_Lo respectively.

***Output 1 Use*** ***l***

R/O if not in Config mode, otherwise R/W. Legal range: 0 to 5 signifying A1nd, A1nr, A1Ld, A1Lr, O12d, O12r respectively.

***Output 2 Use*** ***m***

R/O if not in Config mode, otherwise R/W. Legal range: 0 to 3 signifying A2_d, A2_r, O12d, O12r respectively.

***Retransmit Select*** ***n***

R/O if not in Config mode, otherwise R/W. Legal range: 0 to 6 signifying None, 0-5V, 1-5V, 0-10V, 2-10V, 0-20mA and 4-20mA respectively.

***Total Scale Factor*** ***o***

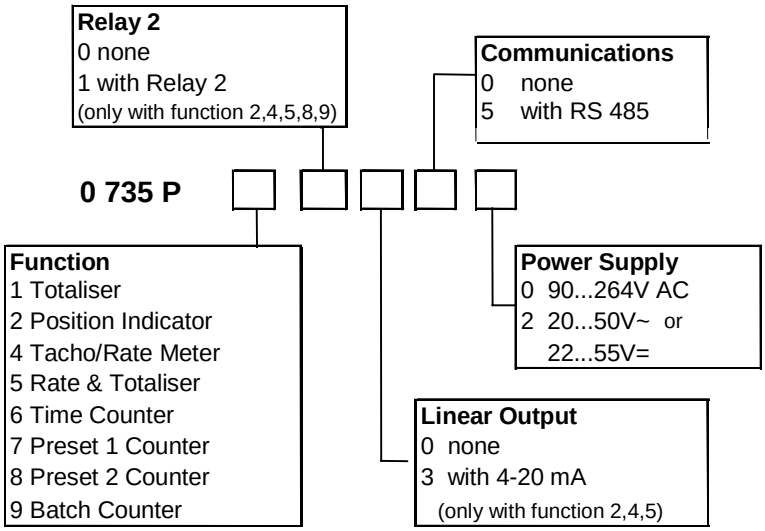
R/O if not in Config Mode, otherwise R/W. Legal range: 0 to 2 signifying sEc, Min, Hr respectively.

***Strain Gauge PSU Select*** ***p***

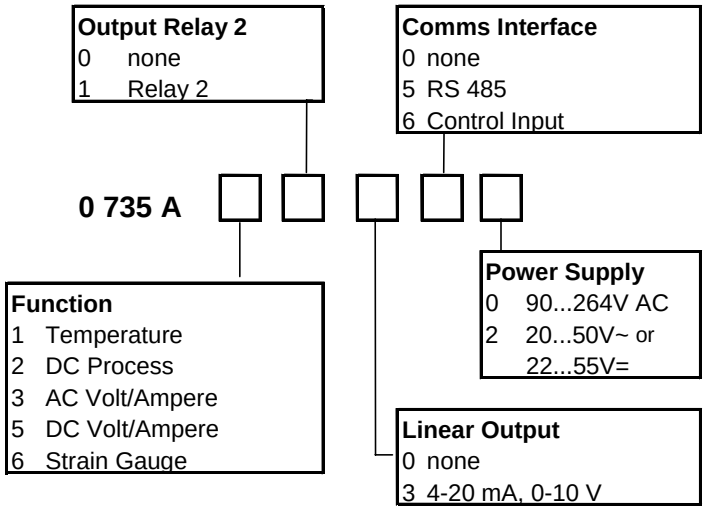
R/O if not in Config mode, otherwise R/W. Legal range: 0 or 1, signifying 5V or 10V respectively.

## Ordering Information

### Counters




### Process Indicators



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