

PETROTEC	CEM 03	REF. 357.02.A.2
2008.09.08	COMMUNICATION PROTOCOL	EDITION A REVISION 2



Assistência Técnica ao
Ramo Petrolífero, S.A.

Exclusively for ARAMPATZIS ST&SIA CO

CEM 03

Communication Protocol

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CONFIDENTIAL

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1. General

This document describes the protocol used by the PETROTEC dispensers and multiplexer. This Document is valid for calculator CEM 01/ 02/ 03 Series.

2. Communication Parameters

The protocol characteristics are:

Between multiplexer and host:

4800 bps, 1 start bit, 8 data bit, 2 stop bits no parity bit.

Between multiplexer and pumps:

1200 bps, 1 start bit, 7 data bit, even parity bit, 2 stop bits.

3. Control Characters

The following table contains the control characters used.

CHAR.	HEX	DEC	DESCRIPTION
STX	3AH	58	Start of message
ETX1	0DH	13	End of message 1
ETX2	0AH	10	End of message 2
ACK	21H	33	Positive Acknowledge (ACK)
NAK	3FH	63	Negative Acknowledge (NAK)
DLE	10H	16	Data Link Escape

4. Message Format

The data packets have the following format:

STX	OPC	PID	DATA	BC1	BC2	ETX1	ETX2	(n Bytes)
-----	-----	-----	------	-----	-----	------	------	-----------

4.1 Message Fields

4.1.1 STX

This character is used to trigger the reception of a message. If it is received during the reception of a message and before the ETX2 character, the characters received must be ignored and the reception of a new message must be started.

4.1.2 OPC Op-Code

The op-code can be the following characters A-Z, a-z or '\$'. The op-code '\$' is used for internal functions in the multiplexer. The other op-codes have specific functions for the peripherals.

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4.1.3 PID Port Identification

This field indicates from which pump the message is coming or to what pump the message must be sent. In fact, what the multiplexer does is insert the field into a message coming from a pump and strip it out of a message sent to a pump. The port ID starts in 41H (pump 1) to 60H (pump 32). Port ID = 30H refers to the host port.

4.1.4 Data

This is the data field. If any control characters appear in the data field, the DLE character must precede it.

4.1.5 BC1, BC2 Block Confirmation

These two characters are used for error control. They are calculated in the following manner:

- XOR all characters of the message excluding STX and any inserted DLE. This will result in a value between 00H and 7FH.
- Take the high nibble and add 30H. The result will be between 30H and 37H. This value is BC1.
- Take the low nibble. If the value is between 0 and 9 add 30H. The result will be between '0' and '9'. If the value is between 0AH and 0FH, add 37H, the result will be between 'A' and 'F'. This value will be BC2.

For testing purposes the BC characters may be replaced by '##' and the multiplexer will not check the message.

4.1.6 ETX1 and ETX2 End of Message

The message will end with the sequence ETX1 ETX2 (<CR><LF>).

5. Protocol Rules

- A - The STX character is used to trigger the reception of a message. Until the reception of a STX, all characters must be ignored. An incomplete received message must be discarded.
- B - The ACK or NAK character must be sent after reception of ETX2, and not before.
- C - Messages have a fixed length depending on the op-code.
- D - The receiver must check if:
 - No framing, parity or overrun error occurred
 - BC1 and BC2 are correct
 - The frame length is correct for the received op-code
 - There are at least 4 characters between STX and ETX1
- E - If an input buffer overflow occurs all the incoming characters must be ignored and a NAK must be sent after ETX2.

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- F** - The transmitter waits 3 seconds for ACK or NAK to timeout. After this timeout, it will retry the message. The multiplexer works on an endless retry basis if no ACK or NAK is received. After the reception of 16 NAK, the multiplexer will drop the message. This is to avoid a situation of dead lock if something wrong occurs during a transmission (ex. the transmitter tries to send a message to big and continuously overflows the buffer of the receiver).
- G** - If the transmitter gets a NAK then a delay of 500mS must be performed before retry.
- H** - The ACK or NAK characters may appear in the middle of a message except between a DLE character and the following character.

6. Multiplexer Messages

The multiplexer will send status messages to the host:

- A** - On power up.
- B** - When communication with the host is re-established after a communication break.
- C** - Upon a request from the host.
- D** - When a status condition changes in one of the ports or power down.

In situation A, B or C the status for power down and all installed ports is sent. In situation D, only the changed status data is sent. The status message has the following format:

OP-CODE = '\$'

PORTID = 0

STATUS = 000000uuB - Power ok
000001uuB - Power down, multiplexer running on batteries

Note: u = undefined (may be 0 or 1)

OP-CODE = '\$'

PORTID = 41H to 60H

STATUS = '0' - pump connected
'1' - pump not connected or dead

The host may request a status message from the multiplexer with the following format:

OP-CODE = 'R'

PORTID = '0'

COMMAND= 'x' (Not relevant, multiplexer ignores)

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Upon reception of this command, the multiplexer will reply the same way as after power up sending status for all ports.

In order to check if a peripheral or the host is alive, the multiplexer when it has no message to send, will keep on polling the device with a wrong message: "FF<CR><LF>". A NAK will be received. If nothing is received after three retries, the multiplexer will consider the pump, or the host, dead.

7. Pump Messages

The following messages are used for pump control. Only op-codes and data are referred. The complete command must include Port Id. Port Id will indicate which pump is sending or will receive the command. All data in message is ASCII so "1" means 31H. Commas are not transmitted.

7.1 Messages from Pump to Host:

FUNCTION	OPC	DATA (DESCRIPTION)	LENGTH	VALUES
Release req. *	A	Hose number	1	1 – 6
Release req. * *	a	Hose number	1	1 – 6
Error	B	Alarm number	1	1, 2 or 5
Filling start	C	None		
Nozzle back	D	None		
Pump data *	E	Volume	5	99999
		Amount	5	99999
		Hose number	1	1 – 6
Pump data * *	e	Volume	6	999999
		Amount	6	999999
		Hose number	1	1 – 6
Pump data * * *	f	Volume	6	999999
		Amount	6	999999
		Hose number	1	1 – 6
		Tag Token	2	01 – 99
SW Version	H	Version number	6	CVxxxx
Validate Tag * * *	k	Tag number	8	99999999
Lost delivery *	L	Volume	5	99999
		Amount	5	99999
		Unit price	4	9999
Lost delivery * *	ℓ	Volume	6	999999
		Amount	6	999999
		Unit price	4	9999
Lost delivery * * *	b	Volume	6	999999
		Amount	6	999999
		Unit price	4	9999
		Tag Token	2	01 – 99

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Power up	O	None	
Stand alone totals	N	Hose	1 – 6
		Volume	999999,99
		Amount	999999999
Pump Totals	W	Hose	1 – 6
		Volume	999999,99

* Messages used with the 5-digit protocol version

* * Messages used with the 6-digit protocol version

* * * Messages used with the 6-digit protocol version plus Tagging System

7.2 Messages from Host to Pump

FUNCTION	OPC	DATA (DESCRIPTION)	LENGTH	VALUES
Tag Validation * * *	K	Tag Token	2	00, 01 – 99 00 = Not Auth.
Stop Pump	P	None		
Suspend filling	p	None		
Power Down	Q	None		
Data request	R	None		
Switch Off	S	None		
Release Pump *	T	Hose	1	1 – 6
		Unit Price	4	9999
		Grade	1	Always 20H
		Preset indicator	1	0, 1 or 3
		Preset value	3	999
Release Pump * *	t	Hose	1	1 – 6
		Unit Price	4	9999
		Grade	1	Always 20H
		Preset indicator	1	0, 1 or 3
		Preset value	6	999999
Resume filling*	t	None		
Resume filling	z	None		
Pump Tot. Req.	V	Hose	1	1 – 6
SW Ver. Req.	X	None		
Upd. Price Dsp.	Y	Hose	1	1 – 6
		Price	4	9999

* Messages used with the 5-digit protocol version

* * Messages used with the 6-digit protocol version

* * * Messages used with the 6-digit protocol version plus Tagging System

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Other messages are common to all protocol versions.

7.3 Message description

Op-code A - Request for release

The pump will send this message after a nozzle is lifted. The system must answer:

P - Not released

T - Pump released

The pump will keep on sending message A until it is released or until the nozzle is back again. If the nozzle is back, the pump will send message D. The sending of message A is synchronous with the reception of message P, i.e., if the nozzle is still lifted, the pump will only send a second message A after reception of a message P.

Op-code a - Request for release

This op-code is exactly, the same as the A command except it is meant to be used for pumps with 6-digit displays. It is also used with the tagging system.

Op-code B – Error

The pump will send this message if an error occurs during a fill. This message will not affect the pump internal state.

1 = Display error

2 = Pulser error

5 = Totals error

Op-code C - Filling start

The pump will send this message after counting 0,03 litres indicating that a fill is started.

Op-code D - Nozzle back

The pump will send this message when the nozzle is placed back.

Op-code E, e, f - Pump Data

The pump will send this message after receiving a Pump Data Request command R.

Op-code H - Software version

This message is sent upon the reception of message X. It will contain the type of calculator and software version.

Op-code L, ℓ, b - Lost delivery

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If communication breaks during a fill, the pump will stop and keep the fill data in memory. After the communication is re-established, the pump will send the L message with the data in memory.

Op-code N – Stand-Alone Totals

If the pump, by any reason, was selling in stand-alone mode, it will keep totals in memory. When the pump senses communication to a system, it will send N messages, one for each hose with the totals sold in stand-alone mode. After the system acknowledges these messages, they will be cleared off in the pump's memory.

Op-code O - Power up

This message indicates that power up sequence is completed and the pump is ready to accept commands. NO COMMANDS must be sent from the system until this message is received. Stand-alone totals (Message N) and Lost Delivery (Message L) will be sent before Power Up (message O).

Op-code W - Pump Totals

This message is sent after a Pump Totals Request (message V) is sent by the system. These totals may only be reset by changing a switch inside the calculator. They reflect all the volume sold by the pump independently of the mode of operation.

Op-code T - Release Pump

This message is sent by the system to release a pump. It must only be sent after reception of a Release Request (command A). It will be ignored in any other situation. The fields have the following meaning:

- HOSE is the hose number. It must match the hose number of the request (message A).
- UNIT PRICE is the unit price to be used in the fill.
- GRADE is not used it was kept for compatibility with other versions.
- PRESET INDICATOR indicates type of preset
 - 0 = volume preset
 - 1 = money preset
 - 3 = money preset prepaid system. Ex. BNA/OPT.
- PRESET VALUE depends on preset indicator it may be volume or money.

Op-code t - Release Pump

This message is the same as the message T. It is used by the 6-digit version. The difference is on the PRESET VALUE field that allows presetting centilitres or cents.

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Op-code t – Resume Filling

This message is used by the 5-Digit version and is kept for compatibility with earlier versions. To avoid confusion we recommend to use the “z” command for this purpose. After receiving this command the valves are opened and the filling resumed.

Op-code P - Stop Pump

This message will stop the pump motor and closes the valves. The pump will wait for the nozzle to be put back to send the Nozzle back message (command D).

Op-code p – Suspend filling

This message will suspend the filling by closing the valves. Timeouts are still counting even during suspend time.

Op-code Q - Power Down

This message must be sent when the host system is running on batteries. This command has the same effect as the P command, but will force a Nozzle back message D regardless of the nozzle being replaced or not. This is meant to allow pump control to finish all fills in a normal way.

Op-code R - Request for pump data

This message is sent by the host system to request pump data. The pump, will only send pump data only if a fill is running, (message C was sent) and before reception of Switch off command (message S). Pump will answer with message E.

Op-code S - Switch off

This message is sent by the system to signal the pump that the filling data in memory may be discarded and the pump may return to the idle state.

Op-code V - Request for pump totals

This message is used by the host system to read the totals per hose. Pump will answer with message W. This message may be sent at any time. Totals are only updated after the nozzle is back.

Op-code X - SW Version Request

This command may be used by the host system to audit the software version of the pump. The pump will answer with an H command.

Op-code Y - Update Price Display

This command is used by the system to write a value on the unit price displays indicating the price for each product. This command will only affect the unit price displays. The pump does not keep prices in

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memory. The filling price is set by the T command regardless of what is on the displays. We recommend that when a filling ends, a refresh should be performed to the unit price display, if installed.

Op-code z – Resume Filling

This message is used to resume a suspended filling. It will open the valves and resume the filling. If the filling has timed-out it will have no effect.

7.4 Pump State Machine Diagram

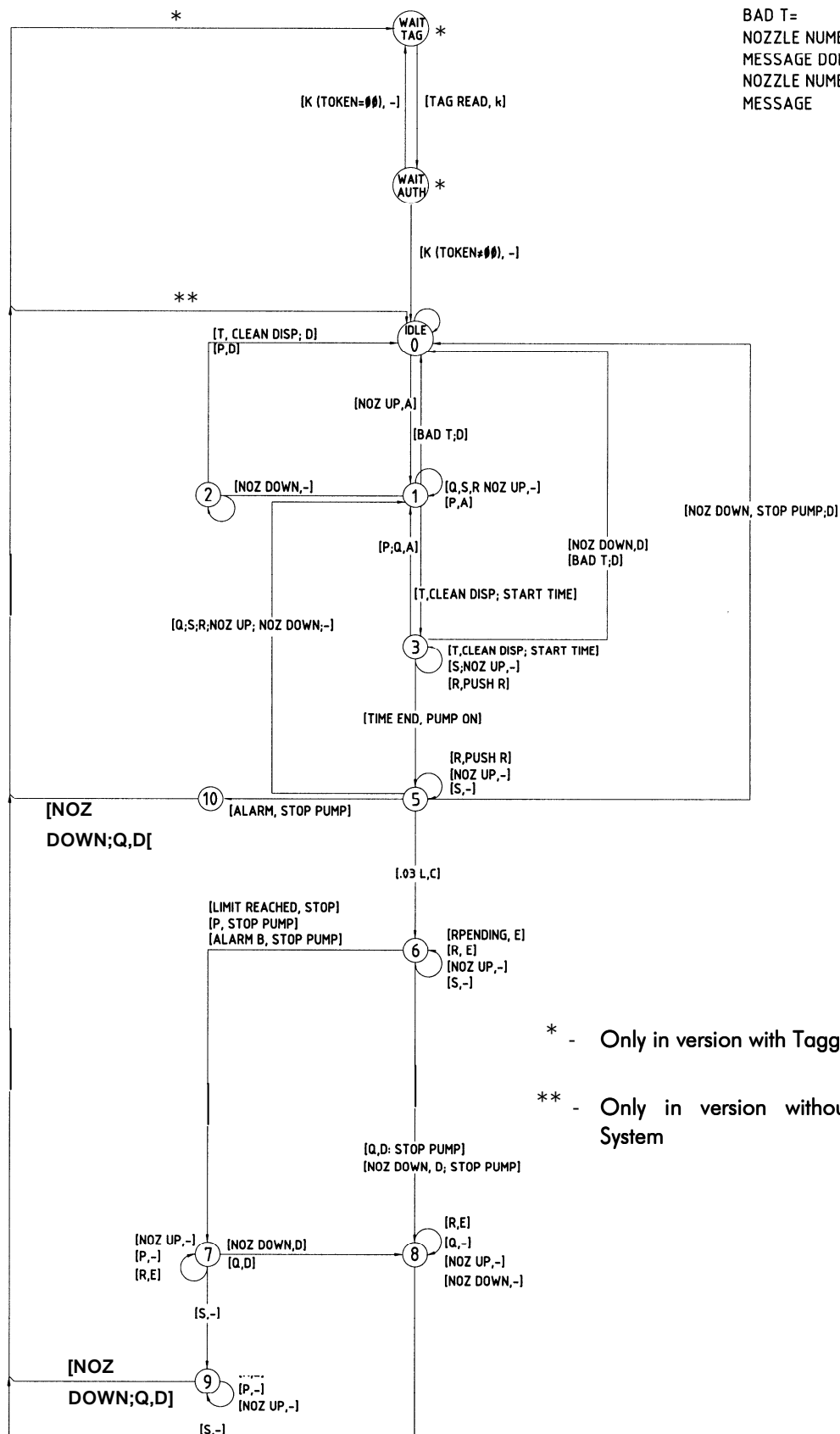
In the next page, the pump machine state diagram is represented. The representation must be interpreted in the following way:

[Event A; Event B, Action X; Action Y]

This means if Event A OR event B occurs then Action A AND Action Y will take place.

Ex.: [Nozzle up,A] = Nozzle is up -> message A is sent
 [Q,D;stop pump] = Message Q received -> D message sent; pump motor stopped
 [Q;Nozzle up,-) = Q message received or Nozzle up -> no effect

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BAD T=
NOZZLE NUMBER ON "T"
MESSAGE DOES NOT MATCH
NOZZLE NUMBER ON "A"
MESSAGE

* - Only in version with Tagging System

** - Only in version without Tagging System

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8. Hardware Interface

