

# LONGER RS485 Protocol for BT100-1L

## 1. Data Format: 1start + 8data + 1even parity + 1stop, 1200bps.

This defines the data format: 1 start bit, 8 data bits, one even parity bit, and one stop bit at 1200 bits per second.

## 2. Command Format: flag+ addr + len + pdu + fcs.

**flag:** E9H is the start **flag** of a command string. Every command string is preceded with the start of E9H.

- In one command string, there is no other E9H except start **flag** E9H. When transmitting, E8H is replaced by E8H 00H, and E9H is replaced by E8H 01H except start **flag**. When receiving, E8H 00H is replaced by E8H, and E8H 01H is replaced by E9H.

**addr:** Pump address (i.e. Pump I.D.#.), take up 1 byte.

- The pump address can be set from 1 to 30. 31(1F) is broadcast address.

- In a command string from the control computer, if the **addr** is pump address, the corresponding pump will execute the command and respond. And if the **addr** is broadcast address, all the pumps execute the same command, and pumps don't respond.

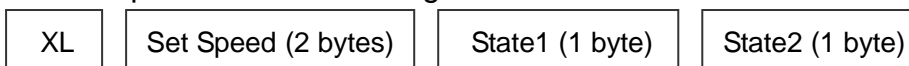
**len:** Length of **pdu**, take up 1 byte.

**Fcs:** XOR of **addr**, **len**, **pdu**, take up 1 byte.

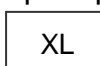
## 3. Pdu Format: application layer code format

### 3.1 Write Running Parameter With Rotate Speed

Control computer command string:



Pump response:



- Speed unit: 0.1 rpm.

- In a command string from the control computer, the **addr** can be pump address (1-30) and broadcast address (31). When the **addr** is pump address, the corresponding pump will execute the command and respond. When the **addr** is broadcast address, all the pumps execute the same command, and pumps don't

# LONGER RS485 Protocol for BT100-1L

respond.

## 3.2 Read Running Parameter With Rotate Speed

Control computer command string:

DL

Pump response:

DL    Show Speed (2 bytes)    State1 (1byte)    State2 (1 byte)

- Speed unit: 0.1 rpm.
- In a command string from the control computer, if the **addr** is one pump's address (1-30), the corresponding pump will respond.

## 3.3 Write Running Parameter With Flow and Pump Head & Tube

Control computer command string:

WL    Set flow (4 bytes)    State1 (1byte)    State2 (1 byte)  
Pump Head No. (1 byte)    Tube No. (1 byte)

Pump response:

WL    Show flow (4 bytes)

- Flow unit: nL/min, 1 L=10<sup>3</sup> mL=10<sup>6</sup> μL=10<sup>9</sup> nL.
- In a command string from the control computer, the **addr** can be pump address (1-30) and broadcast address (31). When the **addr** is pump address, the corresponding pump will execute the command and respond. When the **addr** is broadcast address, all the pumps execute the same command, and pumps don't respond.

## 3.4 Read Running Parameter With Flow and Pump Head & Tube

Control computer command string:

RL

Pump response:

RL    Show flow (4 bytes)    State1 (1byte)    State2 (1 byte)  
Pump Head No. (1 byte)    Tube No. (1 byte)

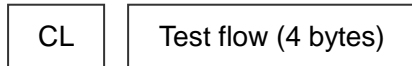
- Flow unit: nL/min, 1 L=10<sup>3</sup> mL=10<sup>6</sup> μL=10<sup>9</sup> nL.

# LONGER RS485 Protocol for BT100-1L

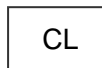
- In a command string from the control computer, if the **addr** is one pump's address (1-30), the corresponding pump will respond.

## 3.5 Flow Calibration

Control computer command string:



Pump response:



- Flow unit: nL/min,  $1 \text{ L} = 10^3 \text{ mL} = 10^6 \mu\text{L} = 10^9 \text{ nL}$ .
- In a command string from the control computer, the **addr** can be pump address (1-30) and broadcast address (31). Pumps can be calibrated one by one with broadcast address.

# LONGER RS485 Protocol for BT100-1L

## APPENDIX

1. The command characters in the **pdu** are characters from the standard ASCII character set.

Command character	C	D	X	W	R	L
ASCII	43H	44H	58H	57H	52H	4CH

2. The most significant byte is transmitted first and the least significant byte finally when transmitting RPM and Flow. The max speed is 100.0 rpm (03E8H).

3. State1: state byte 1.

Bit 0 – start / stop bit, 1 to start the pump, 0 to stop the pump.

Bit 1 – prime bit, 1 to prime the pump at the max speed 100 rpm.

4. State2: state byte 2.

Bit 0 – cw / ccw bit, 1 to run in cw, 0 to run in ccw.

5. Default **addr** : default pump address (i.e. Pump I.D.#.): 1.

6. Pump head No.-Tube No.-Tubeing ID

Pump Head No.	1: DG (6-roller)			2: DG (10-roller)			5: DG15		
Tube No.	1	2	3	4	5	6	7	8	9
Tubing ID (mm)	0.13	0.19	0.25	0.38	0.44	0.51	0.57	0.64	0.76

Pump Head No.	1: DG (6-roller)			2: DG (10-roller)			5: DG15		
Tube No.	10	11	12	13	14	15	16	17	18
Tubing ID (mm)	0.89	0.95	1.02	1.09	1.14	1.22	1.30	1.42	1.52

Pump Head No.	1: DG (6-roller)			2: DG (10-roller)			5: DG15		
Tube No.	19	20	21	22	23	24	25	26	
Tubing ID (mm)	1.65	1.75	1.85	2.06	2.29	2.54	2.79	3.17	

Pump Head No.	3: YZ1515/YZ2515						4: 313D		
Tube No.	1	2	3	4	5	6	7	8	

# LONGER RS485 Protocol for BT100-1L

Tubing ID (mm)	0.80	1.60	2.40	3.10	4.80	6.40	7.90	9.60	
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## 7. Examples

### a. Write Running Parameter With Rotate Speed:

Control computer command string:

E9 01 06 58 4C 00 C8 01 01 DB

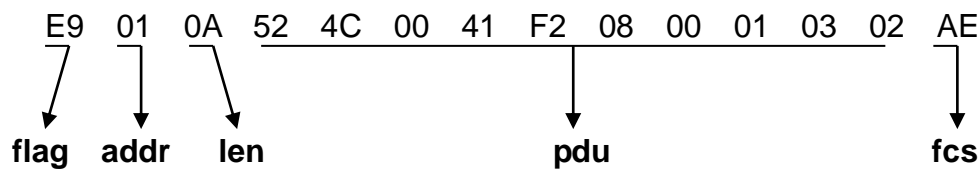
- The above command string from control computer will set running parameter of pump 1 as follows: run cw at 20.0 rpm.

### b. Read Running Parameter With Flow and Pump Head & Tube:

Control computer command string:

E9 01 02 52 4C 1D

Pump response:



52 4C -- RL

00 41 F2 08 – show Flow (41F208H=4321800 nl/min=4.3218 ml/min)

00 -- stop state

01 -- Run in cw

03 – YZ1515/YZ2515 pump head

02 -- Tubing ID: 1.60 mm

## 8. DB-15 External Control Interface

Pin 2 - RS485 B

Pin 3 - RS485 A