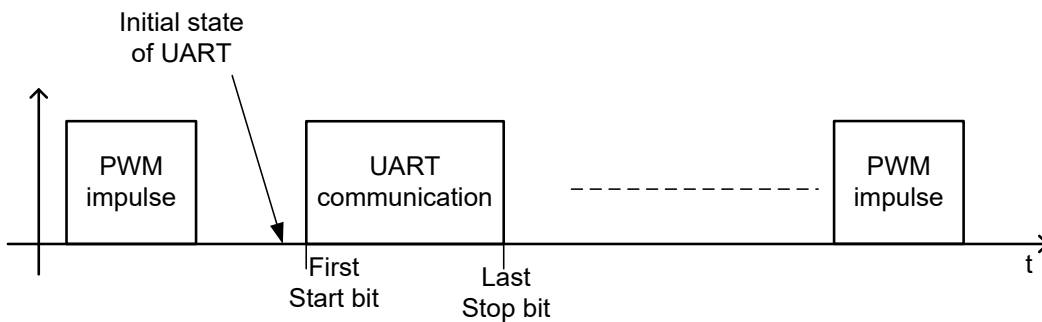


## PWM TELEMTRY AND COMMUNICATION PROTOCOL

### Overview:

ProMotion telemetry servos are capable of returning data collected from the operation of the servo to the controlling device via the signal wire. Data packets are sent between PWM command pulses.

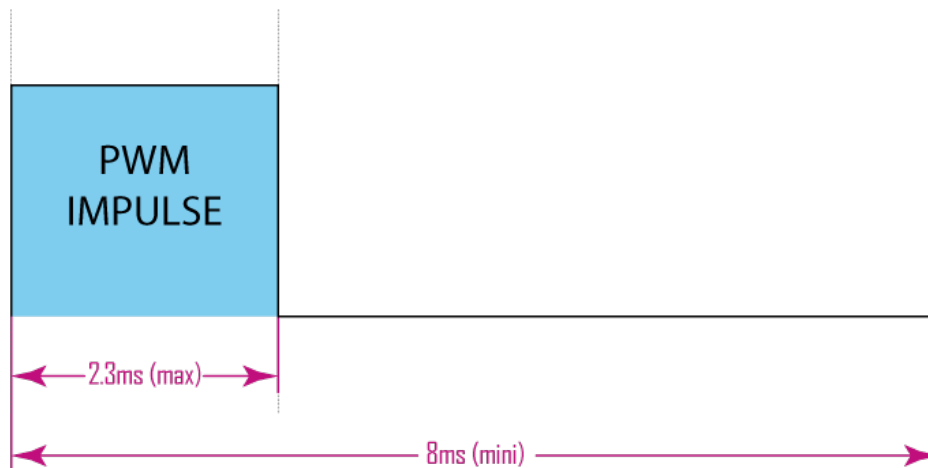
The initial state of the UART is logical 0, which is generated directly after the PWM impulse.



### I. Impulse Timing :

**Max** frequency (PWM Signal) for telemetry and communication: 125Hz (Tmin=8ms)

Max PWM Impulse length = 2.3ms



### II. UART Configuration:

Communication speed: 57.6 kBaud

Number of data bits: 8

Number of stop bits: 1

Parity: none

III. **Packet format :**

*Telemetry packet sent by servo when telemetry is active and master doesn't send any request.*

Byte No.	Length[Byte]	Data	Note
0	1	0x3A	Header Reply "Telemetry"
1	1	0x00	Status
2	1	ADDR	Address of the telemetry DATA
3	1	DATA_LEN	Length of the data to read
4	DATA_LEN	DATA	Data
4+DATA_LEN	1	CRC8	
4+DATA_LEN+1	1	SECURITY	SECURITY BYTE

*Packet with read data request (sent by the master asking for data answer)*

Byte No.	Length[Byte]	Data	Note
0	1	0x2B	Header "Read data"
1	1	0x00	Status
2	1	ADDR	Address of the data to read
3	1	DATA_LEN	Length of the data to read
4	1	CRC8	

*Reply to the master read data request*

Byte No.	Length[Byte]	Data	Note
0	1	0x3B	Header Reply "Read data"
1	1	STATUS	Status
2	1	ADDR	Address of the data to read
3	1	DATA_LEN	Length of the data to read
4	DATA_LEN	DATA	Data
4+DATA_LEN	1	CRC8	
4+DATA_LEN+1	1	SECURITY	SECURITY BYTE

*Packet with write data request (sent by the master for write data)*

Byte No.	Length[Byte]	Data	Note
0	1	0x2C	Header "Write data"
1	1	0x00	Status
2	1	ADDR	Address of the recorded data
3	1	DATA_LEN	Length of the recorded data
4	DATA_LEN	DATA	Data
4+ DATA_LEN	1	CRC8	

*Reply to master write data request*

Byte No.	Length[Byte]	Data	Note
0	1	0x3C	Header Reply "Write data"
1	1	STATUS	Status
2	1	ADDR	Address of the recorded data
3	1	DATA_LEN	Length of the recorded data
4	DATA_LEN	DATA	Data
4+DATA_LEN	1	CRC8	
4+DATA_LEN+1	1	SECURITY	SECURITY BYTE

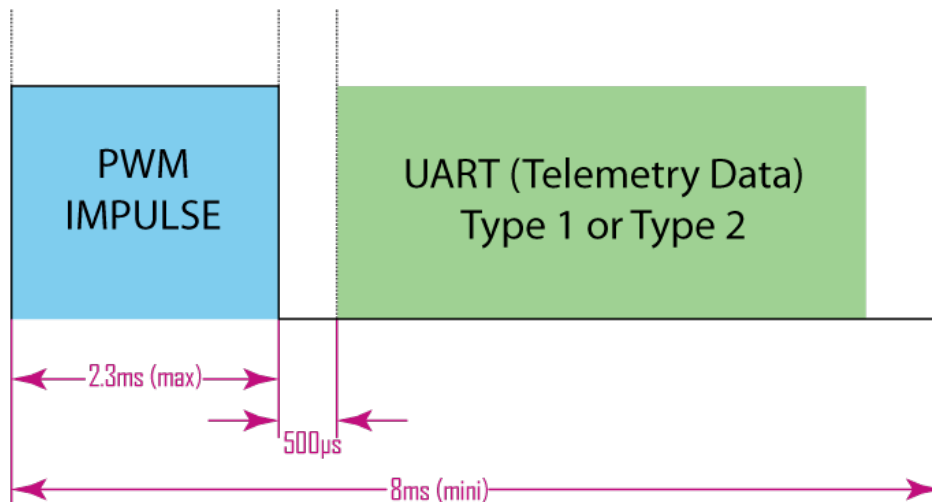
SECURITY BYTE definition:

This Byte is added to end of the packet

Purpose is to identify a non-original Ditek or Pulse servo

Telemetry :

If telemetry is active (enabled in the GUI) in the servo, and master doesn't have any request, the servo always sends a telemetry packet.



There are 2 types of telemetry (selectable by configuration software « PULSE Manager »).

1. Telemetry TYPE 1

In this mode, the servo sends a different data point value for each pulse.

There are 14 different data points for a complete telemetry loop (14 pulses @ 125 Hz => Loop time to receive all the telemetry information = 0.112ms).

Information Number	Address	Length**	Pos. decimal point	Range	unit	Servo settings	Data functions	
1	210	1	0	Bit mapping	none	Actual values	Servo Status***	
2	211	2	0	700 ~ 2300	us		Pulse received target position	
3	213	2	1	+/- 18000	° angle		Actual angle from the offset position	
4	215	2	1	0 ~ 100	%		Actual Torque (%)	
5	217	2	1	0 ~ 250	V		voltage (V)	
6	219	1	0	-40 ~ 125	° C		Actual temperature	
7	220	2	1	+/- 32000	°angle/sec		angular velocity	
8	222	4	0	##	second / minutes		Servo powered time (cumulative)	
9	226	4	0	##	second / minutes		total motor run time (cumulative)	
10	230	2	1	0 ~ 200	A		Current (A)	
11	232	1	0	-40 ~ 125	° C		Min / Max values	max. temperature
12	233	2	1	0 ~ 200	A			max. current
13	235	2	1	0 ~ 125	V			min voltage
14	237	2	1	0 ~ 125	V			max voltage

Telemetry information table:

Servo run time = total time circuit board is powered.  
Total wear out = total time motor is powered.

2. Telemetry TYPE 2

In this mode, the servo sends a unique frame formed by the 11 essential telemetry data points between each PWM pulse. The 11 data points are sent in the same frame and are each an individual length of 2 bytes, the data field is 22 bytes length).

Telemetry information table:

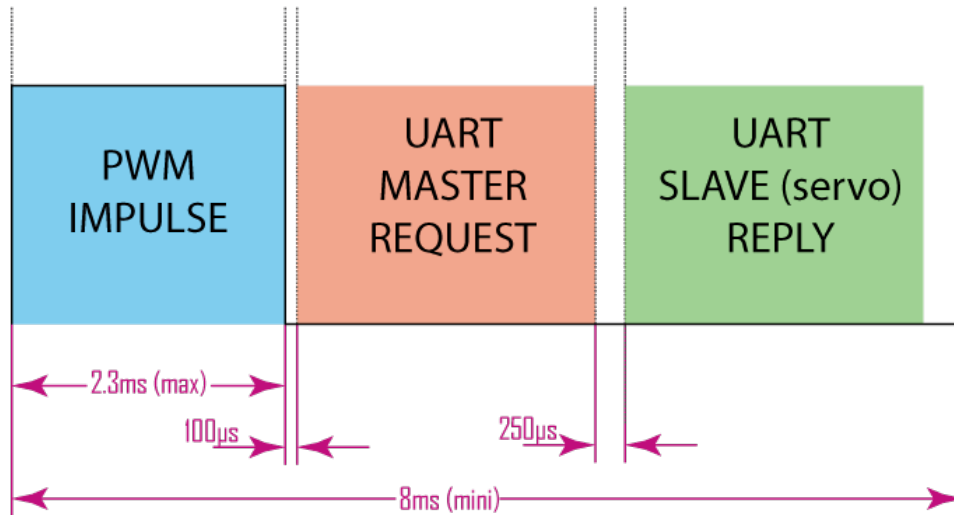
Information Number	Address	Length**	Position in DATA Field	Pos. decimal point	Range	unit	Servo settings	Required functions		
1	255	22	2	1	0	700 ~ 2300	us	Actual values	Pulse received target position	
			2	2	1	+/- 18000	° angle		Actual angle from the offset position	
			2	3	1	0 ~ 100	%		Actual Torque (%)	
			2	4	1	0 ~ 250	V		voltage (V)	
			2	5	0	-40 ~ 125	° celcius		Actual temperature	
			2	6	1	+/- 32000	°angle/sec		angular velocity	
			2	7	1	0 ~ 200	A		Current (A)	
			2	8	0	-40 ~ 125	° celcius		Min / Max values	max. temperature
			2	9	1	0 ~ 200	A			max. current
			2	10	1	0 ~ 125	V			min voltage
			2	11	1	0 ~ 125	V			max voltage

IV. Accessing shared data:

If the data exchange mode is active in the servo (set in PULSE MANAGER), the master can send a read or write request to the servo. In case telemetry is also active, if the master sends a request, the servo will reply to this request (telemetry automatic packet is suspended for this impulse period and will be reactivated on next impulse).

## 1. Data request timing

Example with minimum impulse period ( $F=125\text{Hz}$ ) and maximum impulse time ( $T_{\text{pulse}}=2.3\text{ms}$ )



All the parameters are accessible by request command except the all in one telemetry frame (telemetry type 2 frame). This offers the possibility to request telemetry data one by one even if automatic telemetry is disabled.

All the write commands modify the parameters only in the RAM of the servo.

**If the servo is powered off or reset, the modified settings are lost.**

To save all the new setting from RAM into the FLASH memory of the servo, the special command 186 must be sent.

After receiving the recording setting command, the servo will reply to this command immediately (as with the other commands) and then it will run the saving sequence.

Note: once the save command is sent, the servo is stopped for 100ms while the MCU rewrites the complete set up in FLASH.)

During this procedure, the servo doesn't reply to serial commands, doesn't send telemetry packet, or impulse time modification. The motor / servo arm brake is active, but not controlled.