

4ET Telemetry User Guide



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Theory of Operation

The 4ET is a Physiotel[®] transmitter that will allow measurement of four different biopotential readings. Included in these measurements but not limited are EOG, EMG, ECG and EEG. This transmitter also has the capability to monitor from multi-housed animals. The signal from this transmitter can be manufactured to broadcast over one of two different frequencies. The new frequencies accommodate more channels and higher bandwidth. These new features also accommodate more flexibility for study design than the standard DSI transmitters.

There are two different frequencies that can be used with this transmitter, allowing two animals to be housed together while simultaneously collecting data from each animal. The other option would be to house single animals closer together without the worry of crosstalk.

Use of this transmitter begins with implanting the different components of the transmitter. Unlike other standard transmitters from DSI the 4ET has two housing units with an IS-1 connector to make up the entire transmitter. The leads are attached to the housing unit that is termed as the sensing unit. The battery is housed in the telemetry unit along with the signal relay components. The transmitter is designed to accommodate the option of replacing the telemetry unit without removing the sensing unit. Since there are two different frequencies it will be important to note the frequencies that are implanted in animals.

The receiver that is compatible with this transmitter is the RPC-2. This receiver has the ability to collect from two different frequencies simultaneously. There are two carrier lights, two power lights, two cables and takes up two slots on DQ ART. When pair housing the animals you will need a spacer in between the receiver and the animal's cage.

Specifications

Naming Convention

The 4ET model name, for example H4ET-S1, is defined by the following:

The first alpha value is indicating if it is hermetic: H4ET-S1

H = Hermetic

No letter = Non-hermetic

The next alpha-numeric value is indicative of the transmitter type: H4ET-S1

4E = four biopotential channels

T = temperature channel

The last alpha-numeric value represents size and frequency of transmitter: H4ET-S1:

S1 = small animal, frequency 1

S2 = small animal, frequency 2

L1 = large animal, frequency 1

L2 = large animal, frequency 2

Part Numbers

Presently there are two sizes of 4ET transmitters available:

	4ET (Small animal)		H4ET (Large animal)	
Frequency 1	270-0142-001	4ET-S1	270-0140-001	H4ET-L1
Frequency 2	270-0142-002	4ET-S1	270-0140-002	H4ET-L2

** Part numbers for the 4ET and H4ET include both the sensing module and telemetry module. For a telemetry replacement module only see table below.

Replacement parts:

Telemetry Module

	Small animal		Large Animal	
Frequency 1	270-0141-001	TM-S1	270-0139-001	TM-L1
Frequency 2	270-0141-002	TM-S2	270-0139-002	TL-L2

General Specifications

	Small Animal	Large Animal
Physical		
Weight/mass (gm)		23.4
Volume (cc)	8.66	12
Minimal animal		
Weight	175 gm	
IS-1 lead length	6.5cm (2.5 inches)	6.5cm (2.5 inches)
Biopotential lead length	50 cm	50 cm
On – Off mechanism	Magnetically Actuated	Magnetically Actuated
Receiver compatibility	RPC-2	Repeater System
Electrical		
Max input voltage	± 1.25 mV	± 1.25 mV
Bandwidth	1-100 Hz	1-100Hz
Transmission distance		
Battery Specifications		
Battery life	3 months	6 months
Warranted Implant Duration		
Sensing module		
warranted implant	3 years	3 years

Telemetry module warranted implant	1 year	1 year
Environmental Operating Temperatures (Celsius)	34 – 41	34 – 41
Other Refurbishable	No	No

Dimensions

Below are drawings that give dimensions of RPC-2, sensing and telemetry module:

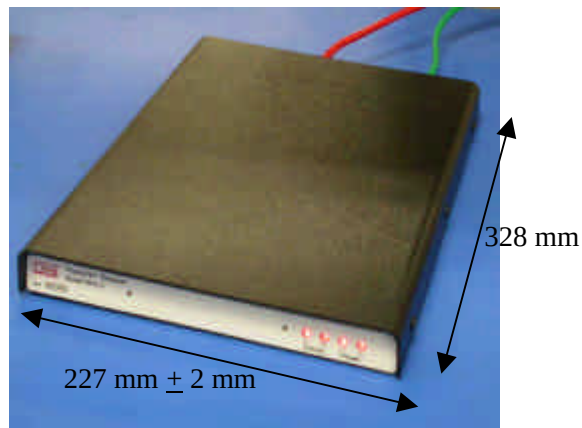


Fig 1. RPC -2 Receiver

Sensing Module

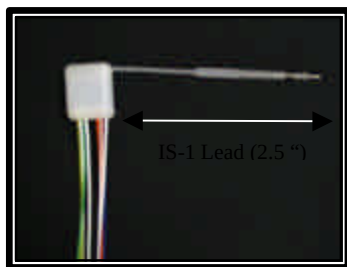


Fig. 2 Non – Hermetic

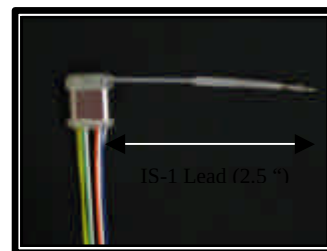


Fig. 3 Hermetic

Telemetry Module



Fig. 4 SA Telemetry Module



Fig. 5 LA Telemetry Module

FCC Compliance Statement

This device complies with Part 15 of the FCC rules and Industry Canada RSS 210. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference that may cause undesired operation.

Caution:

Changes or modifications not expressly approved by the party responsible for compliance could void the users authority to operate the equipment.

FCC and Industry Canada (IC) ID

	<u>FCC IC</u>	<u>IC ID</u>
4ET SA 8MHz Implant	FCCID:MHATMS1	IC:5681A-MHATMS1
4ET SA 18MHz Implant	FCCID:MHATMS2	IC:5681A-MHATMS2
4ET LA 8MHz Implant	FCCID:MHATML1	IC:5681A-MHATML1
4ET LA 18MHz Implant	FCCID:MHATML2	IC:5681A-MHATML2

Setup

Product Use

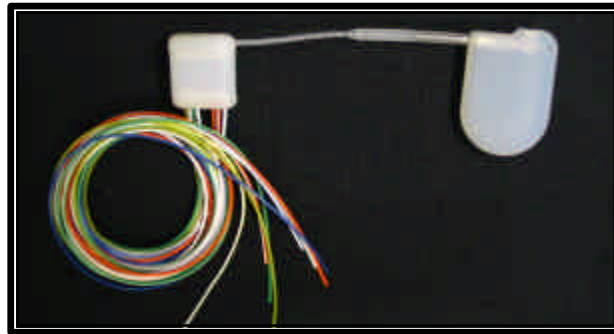
Sensing Module:

- o Portion of the transmitter that collects the data from the animal.
 - Channel 1 Blue (internal ground)
 - Channel 2 Orange
 - Channel 3 Green
 - Channel 4 Yellow
- o Positive Lead: Solid
- o Negative Lead: Solid + White Stripe
- o Implant channels 1 and 3 using the most stable signals (low baseline wander)

- These channels are shared with other parameters (temperature, battery, voltage, ground) that could become inaccurate with excess wander from biopotential.
- DSI suggests using channels 1 and 3 for EEG or EMG

Telemetry Module:

- Portion of the transmitter that transmits the data to the receiver. This also is designed to be replaceable since it houses the battery as well. The IS-1 lead is also connected to this module with the ability to disconnect the IS-1 from the sensing module and replace the telemetry module. This module also houses the frequency designation that is broadcasted to the receiver.
- Can be in two different modes: free-run and normal. Free-run mode is the ability to turn on the telemetry module without having the sensing module attached. The tone heard should be lower than the normal mode. Normal mode is the mode needed to be in to collect data.



Matching Transmitter with RPC-2 Receiver

The 4ET SA transmitter must be used with the RPC-2 receiver regardless if animals are pair or single housed. It will have two Ethernet cables coming out the back of the receiver to the matrix as seen in figure 1. Two jacks on the data exchange matrix will also be needed. Consequently this means that there will be two sampling slots needed in the software even though there is only one receiver. It will be necessary to connect both cables coming from the same RPC-2 receiver into the same matrix. However it won't be necessary to connect the cables in adjacent jacks. The two carrier lights on the front of the receiver will be indicative of which signal is being picked up. The two power lights on the front will be illuminated when the receiver is getting power for both frequencies to be detected.

The RPC-2 receiver can be used to monitor from one animal or two animals. If monitoring from two animals it will be necessary to house two animals with different frequencies. Additionally with pair housed animals a 2.5" spacer is needed in between the receiver and the cage to avoid crosstalk between the animals. This spacer will be included with the purchase of an RPC-2. When animals are paired housed the RPC-2 receivers are going to need further separation between receivers, about 30 inches should

sufficient. The other option would be to individually house the animals. Animals housed individually will be able to have the cages closer together and there will be no need for a spacer.

Software Setup

Setup of the 4ET transmitter with the Dataquest ART system will be a tedious process. Keeping track of all the information on the transmitters and where they are implanted and what receiver they are being placed on will be crucial in making this process go smoothly. There is a log at the back of this manual that will aid in the organization of setting up the transmitters.

Configuring the RPC-2

The RPC-2 receiver will be detected automatically by the software just as the RMC and RPC receivers do. Once the RPC-2 receiver has been detected by the computer it will show up as two different receivers with two names:

- RPC-2 F1 SN XXX
- RPC-2 F2 SN XXX

The F1 and F2 are referring to the 4ET frequency that is being detected. F1 is referring to the 8 MHz channel and the F2 is referring to the 18 MHz channel.

If there is only going to be one transmitter on a receiver then it won't be necessary to configure anything on the receiver for the channel that is not being used.

Configuring the 4ET transmitter

Follow the listed steps to get the 4ET transmitter configured properly:

1. If using the 4ET with the Dataquest ART 4.0 there is a patch that will be needed. All software previous to Dataquest ART 4.0 is not compatible with the 4ET transmitter. Any software following Dataquest ART 4.0 will be compatible with the transmitter without an additional patch.
2. All the transmitters that are using the 8 MHz frequency will need to be configured on the F1 receivers. The 18 MHz frequency transmitters will need to be configured on the F2 receivers.
3. After the appropriate receiver has been chosen then select to add a new transmitter to the particular receiver. The 4ET transmitter will be listed as 4ET S1 or 4ET S2. (Whether using hermetic sensing module or not)
4. A number of calibration values will need to be entered at this time as well as the signal type used for each channel. There are no limitations regarding what signal can be detected from each channel. DSI however does have two suggestions: for channels 1 and 3 use a more stable signal, for example the EMG or EEG. The other suggestion is if using this smaller transmitter in a larger animal to detect ECG the lead placement would be best closer together, since the input voltage range for the channel is ± 1.25 mV.

5. Following the manual configuration of the transmitters you can close the configuration hardware window and return to the acquisition window. Before you start sampling from the animals you will want to be sure the transmitters are turned on by using the radio provided. Use the S1 channel to monitor the 8 MHz transmitters and the S2 channel to monitor the 18 MHz transmitters.