CyberSense

BPM02
CyQ® 103/302

OPERATORS MANUAL

BPM02.11.1

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QUICK START

You need to connect two cables and a wall transformer.

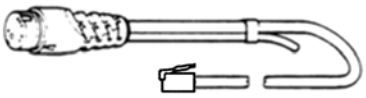
1. The first cable is white and goes from the pressure transducer to the phone jack labeled ‘Sensor’ on the back of the CyQ103.

2. The second cable is a jumper (interconnect) telephone cable. Plug this into the phone jack on the CyQ103 labeled ‘Output’ ; plug the other end into *either* phone jack on the CyQ302 module.

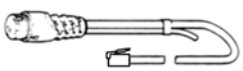
3. Now connect the wall transformer to either the 103 or 302. Flip the red handle power switches on (up or towards you).

Detailed Setup

1. Connect transducer INTERFACE CABLE to the modular receptacle labeled INPUT on the back of the 103 case.

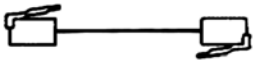


2. Plug TRANSDUCER into INTERFACE CABLE. Press the connectors together **very** firmly.



3. If the output signal is being sent to additional CYQ modules, for

example, a CYQ30X display, then connect an interconnect cable from the 103 OUTPUT modular receptacle to either 302 modular receptacles. There are two receptacles for daisy-chaining modules. An interconnect cable has a phone plug on both ends with the release tab up on one end and down on the other end.



If you are making a cable or using a telephone cable purchased elsewhere then make sure 1). It has 4 or 6 conductors, 2). The plugs are flipped on opposite ends; that is, with the cable flat the release tab must be up on one end and down on the other.

4. Insert WALL TRANSFORMER barrel plug into the 103 POWER receptacle.

The wall transformer output rating should be 9 VDC unrregulated and the

current rating should be at least 200 ma. The power input of all CYQ modules is diode protected against reverse voltage and surge protected against levels above 20 VDC.

5. Plug WALL TRANSFORMER into wall outlet.

The blue light (center lower 103 case) should be on.

CONTROLS

Offset - Zero/ Balance Switch

Up position: The offset control is active and adds a voltage to the output.

Center position: No offset is added to the output. The output will be zero +/- 0.2 mmHg. The internal offset of the 103 is near zero due to the use of high precision operational amplifiers. The primary purpose of the balance adjust is to compensate for transducer bridge imbalance with zero pressure applied. A properly balanced signal conditioner (actually properly imbalanced to compensate for the transducer imbalance) will be within 0.2 mmHg (2 mv) of zero at the output with zero mmHg applied to the transducer.

Down position: This activates the internal automatic balance adjustment. The purpose of balancing is simple. The signal conditioner amplifies the output voltage caused by pressure creating imbalance in the transducer. In a perfect world the transducer bridge would be perfectly balanced with zero pressure applied. In the real world it is not; there is a signal present even though the input pressure is zero. This can be seen by changing the gain control. Zero times any gain should still be zero. However, if there is imbalance then a signal is present with zero pressure, and the signal conditioner output will change when the gain is changed. This makes it very hard to properly adjust the gain since the baseline keeps changing. You end up going in a circle; yes, there is a method for adjustment that converges, but it is tedious and requires many repetitions.

The autobalance feature of the CYQ103 adds in a voltage to force the output of the preamplifier stage to zero. Once this is done (for zero gage pressure) then the gain may be adjusted for 100 mmHg pressure applied without concern for baseline shift.

This is a momentary position and the switch will return to center when it is released. This initiates a balance cycle, the blue light below the switch will blink. When balance is complete the blue light will stop blinking. Output should be less than 0.1 mmHg or 2 mv. Balance data is retained in flash memory. Thus, the balance setting is retained as if it were set by a mechanical control.

It is good practice, after a 15 or more minute warmup, to set balance and check calibration whenever possible.

Gain

Gain is adjustable from 200 to 700. The nominal setting with a standard 5 uV/Vexc/mmHg transducer is about 200 on the vernier dial. Gain adjustment should be preceded by balance. The range is sufficient to allow calibration to either 10 mv/mmHg or 10 mv/cmH2O.

Offset

Offset is adjustable from -2.8 to +2.8 volts. This is added to any signal present at the output. Center scale on the vernier, 500, is approximately zero volts. This control may be used to trim out any slight residual output at zero pressure. It may be used to allow negative pressures to be measured by a positive input only device such as a 0 to 5 VDC A/D converter or chart recorder.

Time interval thumb wheel switch

This sets the interval in seconds that is used to find the minimum and maximum blood pressure, that is, **systolic** and **diastolic**. The time interval should be sufficient to capture at least two beats. The display is updated at the end of each interval. Note that zero on the dial corresponds to the display being updated every 0.5 seconds. If the thumbwheel dial is set to 1 then the display is updated every 1 second.

The **mean** is calculated from the last 3 intervals. It is updated at the end of each interval. This is needed to smooth out variations caused by the sampling interval being different from the heart rate.

We use a more convenient version of the thumb wheel switch where the thumb wheel, with the numbers on the wheel, is replaced by up and down buttons on the switch. This is why pressing the lower button (rolling the thumb wheel down) will cause the interval to increase while the upper button will cause it to decrease (rolling the thumb wheel up).

CALIBRATION

In a research setting pre calibration is not an option. All bridge pressure transducers are temperature sensitive - about 2 mmHg per degree centigrade. Heating pads and surgery lamps are potential sources of such temperature changes, also, many buildings decrease air conditioning at night. Temperature changes affect the transducer and change both BALANCE and GAIN. (The 103 signal conditioner has a temperature sensitivity less than 0.1 mmHg per degree Celsius.) Since there is no way to know the temperature at which precalibration was done, the accuracy becomes an unknown.

Furthermore, pressure transducers vary between units in both offset and gain. Switching transducers either during or between experiments can lead to shifts of several mmHg. While this may not matter in most clinical settings, in a research study this can easily change a $p<0.05$ to $p = 0.06$ in a 10 animal study.

Quick
Setting the gain control to 200 and pressing the balance switch is sufficient for ballpark calibration to within +/- 4 mmHg , +/- 2 nominal.

Standard - using a mercury manometer
1. Make sure the pressure transducer has zero mmHg applied, that is, it is vented to atmosphere. Set the 302 interval switch to 0.

2. Press the balance switch down and release - the blue light should blink for a few seconds. When the light stops blinking, the output should be less than 0 mmHg displayed. This completes balance and offset adjustments because a mercury manometer can only be read to 0.2 mmhg. (The divisions on a mercury manometer are at 2 mmhg intervals.)

4. The 103 contains a flash memory to remember the balance setting in case the 103 is unplugged and someone forgets to balance the unit the next time it is used.

3. Apply 100 mmHg and adjust GAIN control to display 100 (1.00 volts output).

Best - minimizes systemic errors

Calibration using a water manometer is needed to achieve maximum accuracy. One mmHg equals 13.6 mmH2O. A cm of water is easy to read and is about equal to a (much harder to read) mmHg. This allows calibration to 0.1 mmhg with minimal effort. A U-tube manometer may be made using common plastic tubing. A meter stick will serve for readout or you may draw fine pen marks on the tubing at 50 cm above and below a fill level mark. Only the level difference matters; the tubing need not be straight.

HYPER TERMINAL

(Included with MS Windows. Updates are on Cnet along with many similar programs such as Tera Term)

From windows

1). Click **programs**
2). Click **Accessories**
3). Select **hyper terminal** if available. If it does not appear on the list of accessory programs, then go to: How to install Hyper terminal.

HOW TO SET UP WINDOWS HYPER TERMINAL

FOR A COM PORT

1) In hyper terminal create a "**new connection**" this can be done by clicking the **Hypertrm.exe** icon or via the menu within HyperTerminal "**File:NewConnection**".

2) Type in a name for the connection (for example, cyq508).

3) Under "**connect using**" select "**Direct to Com 1**" if your available com port is com 1 otherwise select the appropriate com port. Modems are relentlessly selfish about interrupts. So if a modem is present then avoid the modem port and it's cousin. That is, if the modem is on com 1 then avoid both com 1 and 3. Com 1 and 3 share an interrupt while com 2 and 4 share a different interrupt; in this case avoid 2 and 4. If you are using a USB adapter to create a virtual COM port then interrupts are not an issue.

4) Set "**Bits per second**" to 9600.

5) Set "**Data Bits**" to 8.

6) Set "**Stop Bits**" to 1.

7) Set "**Flow control**" to None.

8) Click OK - the hyper terminal screen should appear.

9). Select **properties** from the menu bar.

8) Click on "**settings**", use default: **autodetect** and **back scroll 500 lines**.

9) For **"ASCII setup**" use
a). Sending - check: "**echo typed characters locally**" box. This lets you see the commands you type in. Alternatively you may send the **ck;** to the cyq module it will echo received characters.

b). Receiving - check: "**wrap long lines**". The 508 sends cr lf in all formats except binary. A cr lf is also echoed by sending ";" or the enter key.

10) Under "**File**" menu select "**Save As**" and save the configuration file to a convenient folder.

You can create a shortcut to the configuration file and put it on the desktop, this makes life a bit simpler. The configuration files have a naming convention of *.ht where star is the name you chose when setting up the new connection. For example, "BPM02.ht".

You now have a basic DATA ACQUISITION SYSTEM

The transfer button on the hyper terminal menu bar will allow you to save received data to a file. You can put the CyQXXX in continuous mode and the data will go to the file name that you select (default is programs/accessories/capture.txt). You can then import this file into a spreadsheet or whatever. You can also direct the output to a line printer for hard copy.

Notes:
1. To change the baud rate DURING a session you must (after going through properties to change the rate) click the 'call' button then 'disconnect' and then 'connect'.
2. The ANSI terminal option will display all ASCII characters including symbols for the unprintable ones.

HOW TO INSTALL HYPER TERMINAL

1). Click on **Control panel**
2). Click on **My Computer**
3). Click on **Install/Remove Programs**
4). Click on **Windows settings**
5). Click on **Communications**
6). Select **Hyper terminal** and click **apply** or OK at the bottom. You will be prompted for your Windows CDROM.
7). Done and out'ta there.

CyQ 302 COMMANDS

There are three kinds of commands. *Configure* commands are used to change parameters such as interval between conversions or number of points to average. *Acquire* commands cause or enable conversions to occur. *Utility* commands include memory, baud rate, and other housekeeping chores .

Typing **?;** or ?<ENTER> will print out the current status.

All commands **MUST end** with either a semi-colon '**;**' or the ENTER key. The command is buffered, but not processed by the CyQ device until a ';' or '\r' is received. The backspace key may be used for corrections.

Where possible the command format allows a value to be assigned with an '=' following the command code or for the feature to be turned on or off with a logical t, f character instead of the '=' sign. This allows setup values to be defined and preserved for future use. It allows the feature to be reactivated with a minimum of hassle. For example: "cfm=3;" will set a median filterl to 3, but it will not affect the usage of the median filter. If the median filter was initially off, then it may be turned on at a later time by "**cfmt;**" (or the abbreviated "**cfm;**') To stop using this filter issue the command "cfmf;" Again, note that "**cfm=3**" neither turns the filter on or off, but will change the setting of a running filter..

In the following N is an integer number; L is a logical true or false, and X is a hexadecimal number. A logical, L, may be T, t ,1 or ';' for true, or F, f, 0 for false.;

SUMMARY OF COMMANDS

aCCCCC; acquire where N is a channel character: s,d,m,p,r.
s; stop.
g; go

Configure

Mode

cmtL; timer selector: false is timer switch on 302 module,
true is external CPU (see next command).
cmt=N; N=Time between samples in external CPU timed mode
cthl=N; Threshold level high
ctll=N; Threshold level low
ctch=N; " Count high
ctcl=N; " Count low

Output

cop = N; Set output prefix, 0 is none.
con = N; Set postfix: 0 = none, 1 is cr, 2 is lf, 3 is crlf.
coiL; Send index counter
cotL; Send elapsed time in seconds
cot=N; Set elapsed time initial value(0 to 43200 =12 hr)
cocL; Send channel numbers

Utility:
ck; Keystroke (Rx char) echo.
cq; Returns model number.
cq@N; Changes baud rate. N=3 is 9600, N=8 is 57.6kb, N=9 is 115kb.
?; Status (Help) command: A command summary with current settings.
mss; Memory save setup.
mls; Memory load saved setup.
msd; Memory save current setup as default.
mpd; Memory Purge default.
$@R Software Restart. (case sensitive)

BASIC:

1. ‘aCCCCC;’ is the acquire command. CCCCC is one or more of the characters s, d, m, p, r for respectively systolic, diastolic, mean, and pulse pressure while r stands for rate in beats per minute.
For example:
‘asd;’ will cause systolic pressure to be acquired (measured) and sent over the serial interface.
‘asdmr;’ will cause systolic, diastolic, mean and rate to be acquired and sent.

The order of transmission can be changed: ‘asd;’ sends systolic followed by diastolic while ‘ads;’ causes diastolic to be sent first followed by systolic.

2. Stop: “**s;**” Stops data from being transmitted. **CAUTION**: Stop MUST be exited with a GO (“**g;**”) command for the poll (or rate or timed) acquires to work. You will forget this, and frantically pound the keyboard, wondering why nothing is happening.

3. Go: ”**g;**” Allows poll and continuous commands to resume. If stop occurred while a continuous conversion was in effect then the continuous mode is resumed. The DEFAULT mode on power up is stop.

4. Status: “**?;**” A list of commands and current settings. This is helpful during the development phase to make sure that the command you thought you entered was the command you entered. It also serves as a ***Help file*** for the command mnemonics.

WHAT TO DISPLAY

‘**dCCCCC;**’ is the display control command. C is s,m,p,r,i . Selects what to display.

dsmpri; Will cause systolic/diastolic, mean, pulse, rate, and interval to be shown on the display. Cpf; will cause pulse pressure not to be displayed. dp; or dpt; will cause pulse pressure to be displayed once again.

TIMING

"**cmt**;" interval timing control by host computer.
'cmt0;' or 'cmtf; interval is set by interval switch on front of CyQ302 case.
'cmt;' or 'cmtt; or cmt1; interval is set by 'cmt=N; command;

Time between conversions in timed mode: "**cmt=N**;" where N ranges from 1 to 100. DEFAULT=1 sec.

HEART RATE

Blood pressure is measured by an A to D converter at 1000 samples per second. Heart rate is measured by counting the number of samples that occur between two peaks. Noise and artifact (for example, the dichrotic notch) are removed by using a threshold crossing during rising blood pressure to start the timing, and ending the timing when this crossing is repeated. In between a lower threshold must be crossed for the second upper crossing to be valid.

The lower and upper thresholds are determined from diastolic and pulse pressure from the preceding interval (diastolic and systolic are simply the min and max during a measurement interval). This makes the tracking adaptive to changes in baseline and pulse pressure (due to, for example, respiratory artifact).

ctll=N; set threshold level low. The percent of the pulse pressure that is added to the diastolic pressure to get the lower threshold level. For example, if diastolic = 80 mmHg, and pulse pressure is 40 mmHg, then entering a value of 10 (ctll=10;) will set the lower threshold to 84 mmHg. **ctlh=N;** set threshold level high. ctlh=50; would set the upper threshold to 80+0.5x40 = 100 mmHg using the 80, 40 mmHg values for diastolic and pulse pressure from the previous example.

ctcl=N; set threshold counts low. The number of consecutive samples below the threshold low level before a low threshold crossing is declared. **ctch=N;** Number of samples needed above upper threshold to declare.

DATA OUTPUT FORMAT

The output format is csv: "#.###, ###.##....." Channel values are comma separated followed by either or both a CR LF at the end, where CR is carriage return and LF is linefeed. Comma separated value (csv) is a universal format that is accepted by spread sheets such as Excel and numerous other programs.

"**cocL**;" causes channel numbers to be included in the csv transmission ch:value,ch;value....

"**coiL;** " will cause the first number to be an **index** number. This number will increment by 1 for each transmission. 000 001 002 003,....255 and roll over to 000. This feature is helpful in reassuring you that there is no missing data due to the communication link. Turning it off reduces the bandwidth requirement which is in the direction of goodness, that is, if it works with the index, then it is even more likely to work without it.

"cop=N" Sets the output prefix (the sync character that precedes data packet transmission) to ascii value N. For csv the default is 0, no prefix. Examples: 07 will change the prefix to ASCII BEL, the computer will issue a beep; 36 will cause a '$' preceding data, 42 will result in an '*' asterisk preceding data; 61 will result in an '=' equals sign prefix. Put simply, N = decimal position in the ASCII text table.

"con=N" Sets the output postfix (the carriage return, cr, and line feed, lf, characters that follow transmission). N=1 is cr (carriage return), N=2 is lf (line feed)N=3 is both cr and lf, N=0 is neither cr or lf. For csv the default is cr lf.

Utility commands

Baud rate:"**cq@X**;" where X ranges from 0 to A. Sets the transmit and receive baud rates for the A/D serial output. **The DEFAULT rate at power up is 9600**. There is always 1 start bit, 8 data bits, and 1 stop bit; there is no parity. The computer baud rate MUST be changed to MATCH AFTER this command is executed (in hyper terminal you must click properties, and then configure. Baud rate will not change until you click disconnect and then connect on the terminal emulator toolbar).

The values are: 1=2400, 2=4800, 3=9600, 4=14,400, 5=19,200, 6=28,800, 7=38,400, 8=57,600, 9=115,200, A=230,400.

Error reset: "**e;**" turns off the error LED.

MEMORY:

a. Save setup: "**mss;**" Memory write setup .... stores the current setup including modes, channels, and configuration.

b. Read and load setup: "**mls;**", Memory load setup. Loads a saved setup if one is present.

c. "**msd;**" Memory save default. Stores the current setup (baud, mode, configuration)
as the power up default. Replaces (over writes) a previously stored default. You may wish to first test using the write and read saved setup commands,

However, should you accidently save a setup that renders the AD inaccessible (high data rate, etc.) or a year has passed and you forgot the baud rate ... there is an out. The device ***always*** powers up at 9600 baud; it checks for and, if present, loads the stored default after the led's stop flashing (about 2 sec). During the time the LEDs are flashing, pressing the escape (ESC) key will cause the module to skip the load stored default. It will come up with the original safe defaults shown in this manual.

d. "**mpd;**" Purge stored default settings:

Restores the power up defaults of the module to those shown in this manual.

e. "**mld;**" loads stored default settings.

4. **"$@R"** will cause a power on restart (case sensitive - capital R).

5. Echo received characters: "**ck;**" Keystroke echo. Incoming characters are transmitted back to the serial source sending the characters. "ckf;" stops echo.

ERROR Handling

If an error occurs then a line feed will be followed by one or more r 's followed by an error message. The error light will come on, and can only be turned off with an 'e;' command.

cmd Command buffer overflow. More than 16 characters were received before a command could be processed. Either a ';' was dropped, or there was noise, or a key is stuck on the keyboard.

Rx Receive buffer overflow. Too many commands were sent to fast. Usually happens when commands are being sent by a computer program. Place some wait(1 or more ms) statements in the code.

Tx Transmit buffer overflow. Everything was not transmitted before the next data was ready to be loaded for transmission. The buffer will go into a wait loop for about 1 ms to give the uart buffer time to clear; if this fails then this error will be set. The delay may trigger the governor producing a speeding error. Baud rate needs to be increased or the sampling rate decreased.

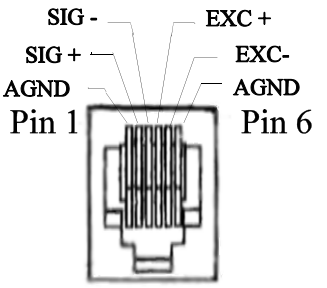
Other errors will result in the following:
The command will be printed up to the offending character, an underline '_' will be printed, this will be followed by a letter where:
'?' means the last character was invalid
'L' a logical was expected: t,f,0,1.
'=' an equal sign was expected. (In some instances both an L and = error will occur.)
'N' a number was expected, or the number is out of range, e.g., a bad channel number.
'X' a hexadecimal number is out of range or the character is not a hexadecimal number.

For example:
type cz;
***cz_? is the error message because 'z' is not a valid configure command character.

INPUTS

Bridge transducer input

This is a 6 conductor modular phone receptacle . It is labeled INPUT and is on the left when the module is viewed from the back. The conductors are gold flashed and rated at 1.5 amperes. Life span exceeds 10,000 connect-disconnect cycles The connections are as follows:



INPUT RJ-11 Receptacle

where SIG+ means that a positive going input signal will cause an increase in output voltage from the signal conditioner. EXC+ is +2.5 VDC and EXC- is -2.5 VDC (50 ppm temperature coefficient) excitation voltage, and AGND is analog ground (goes to the shield on the transducer cable). Inputs are protected at 30 vdc . and can withstand a direct short to either EXC+ or -. Excitation outputs can be shorted to ground or each other without damage to the CYQ 103.

Serial resistance (3 wire) transducers may be used by connecting SIG- to EXC-, using EXC+ for excitation and SIG+ for the signal out. The signal conditioner may be used as a general purpose amplifier by using only SIG+ and SIG- leads.

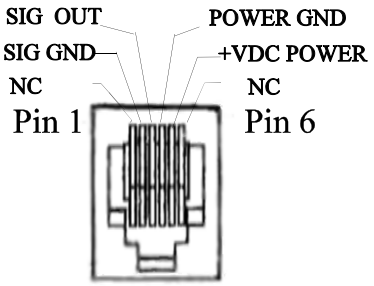
Power input

This is a two conductor barrel receptacle and mates with a 2.1 mm barrel plug. Power is supplied by a 9 VDC wall transformer. The wall transformer must deliver adequate current to drive all attached backlighted LCD displays. We provide a 9 VDC, 300 ma unit with the CYQ 103; this should be adequate to drive 3 backlighted LCD displays.

The power input is varistor protected at 20 VDC against surges and diode protected against reverse polarity. Generally only one wall transformer is needed. If more than one wall transformer is used in a string of modules then the diode protection will cause the load to be shared.

OUTPUT

Signal and power outputs are provided by a 6 pin modular telephone receptacle . The connections are:



OUTPUT RJ-11 Receptacle

SIG. OUT :

This is normally calibrated to 10 mv/mmHg and increases (goes positive) with a positive going signal at INPUT SIG+. The signal out pin may be safely shorted to any other pin on the connector. The output will sink or source 21 ma typically and is guaranteed to deliver 16 ma. The output swing capability is from -3.5 to +3.5 volts. Capacitive loads in excess of 120 pf may cause oscillations (typically, RG59 coaxial cable has 17 pf/ft while RG62 has 14 pf/ft)

+VDC power:

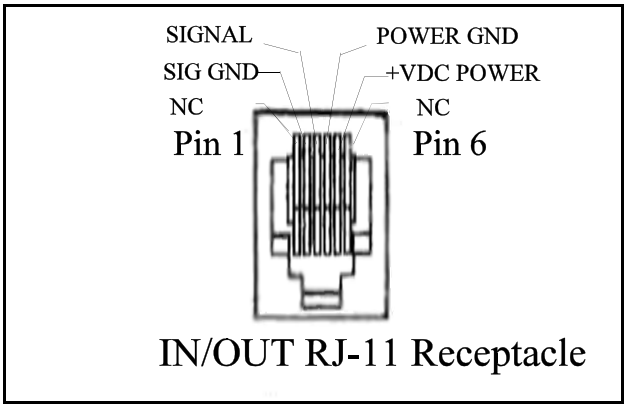
This is the interconnect for unregulated wall transformer power.

GND:

CYQ modules use pins 1 and 2 for signal ground, and pins 4 and 6 for power ground. These grounds are connected at the signal conditioners internal power supply.

IN/OUT

CyQ 302 signal and power interconnections are provided by two 6 pin modular telephone receptacle . These are pass-thru connectors with respective pins connected together. Either connector can be used as either an input or output. This permits daisy-chaining to the next module, for example, an A/D converter or chart recorder. The connections are:



IN/OUT RJ-11 Receptacle

SIGNAL :

This should be calibrated to 10 mv/mmHg and increases (goes positive) with a positive going signal at INPUT SIG+. The signal pin may be safely shorted to any other pin on the connector.

+VDC power:

This is the interconnect for unregulated wall transformer power.

GND:

CYQ modules use pin 2 for signal ground and pin 4 for power ground. These grounds are connected at the signal conditioners internal power supply.

The **heart rate** monitor relies on the systolic and diastolic pressures to track the waveform. For this reason, the time interval should be sufficient to capture at least two arterial pressure pulse.

SPECIFICATIONS

Gain: Optimized for standard 5 uv/v/mmHg transducers. Range: 200-700, 10 turn vernier helipot adjust. Adjustment range includes 10 mv/mmHg and 10 mv/cmH20 scale factors.

Bandwidth: Break frequency 1600 Hz, -3 db or 70.7% voltage. Bandwidths to 35 kHz available on request.

Input:

- **Differential:** 100 kohm to analog ground on each input. Full surge and static protection, 40 vdc maximum sustained.
- **Common mode rejection:** 120 db
- **Noise:** 1.5 uv referred to input (Inputs shorted, gain set to 550, 1600 Hz BW).
- **Drift:** Typically less than 1 mv or 0.1 mmHg/cmH2O per 24 hr drift (inputs shorted), 0.1 mmHg/ deg C ambient.
- **Inputs:** Bridge type transducer signal inputs on pins 2 and 3 of a 6 pin modular telephone jack.

Balance:

- **Autobalance:** initiated by momentary switch depression.
- **Accuracy:** +/- 0.2 mmHg typical, +/- 0.5 mmHg guaranteed.
- **Balance retention:** Indefinite.

Output:

- **Range*:*** bipolar -3.5 to 3.5 vdc. At a gain giving 10 mv/mmHg : -350 to +350 mmHg.
- **Offset adjustment:** 10 turn vernier offset adjustment for adapting to recorders or A/D converters. Approximately -350 mmHg to +350 mmHg adjustment range.
- **Connector:** Signal out (pin 3), analog ground (pins 1, 2), power interconnect (pin 5), and power ground (pins 4, 6) via a 6 pin modular telephone receptacle. Contacts gold flashed, rated at 1.5 Amps**,**

extremely reliable, locking.

- **Excitation:** Excitation voltage provided by a precision +/- 2.35 vdc power supply with a current capability of 20 ma on pins 4 and 5 of the transducer input modular telephone connector (50 ppm/deg C).

Power:

- A barrel type receptacle, 2.1 mm center positive is provided for a 7.5 to 9 vdc unregulated wall transformer rated at 300ma.
- Surge protected at 18 vdc
- Self resetting 500 ma fuse
- Diode protected against reverse input voltage

Physical:

- **Size**: width 4 in.(10 cm), depth 3 in.(7.6 cm), height 2.0 in. (5 cm)
- **Weight**: 7.7 oz (218 g)
- **Material**: ABS plastic case, textured gray.

LEGAL STUFF

Limited Warranty

CyberSense warrants to the original purchaser or end-user complete satisfaction for 90 days - money back or exchange; we pay shipping. This product is warranted to be free from defects in material or workmanship for a period of three years. During this period, and upon proof of purchase, the product will be replaced or repaired without charge for either parts or labor. This warranty is voided if the product is modified, misused, subjected to abnormal environments (for example, submergence in water or harsh chemicals, ovens, etc.).

Purchase price refund for 90 days and repair or replacement for a period of 3 years are the ONLY REMEDY of the purchaser. This warranty is in lieu of all other warranties either express or implied; specifically, any warranties of implied merchantability or fitness for a particular use or purpose. CyberSense shall in no way be liable for indirect or consequential damages of ANY kind or nature.

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