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Highlights of the WB-DynaRes Models

Differential Analog Input Channels

16 Channels: WB-DynaRes 16 Ultra

WB-DynaRes 16

8 Channels: WB-DynaRes 8 Ultra

WB-DynaRes 8

Maximum Resolution

20 Bits (0.00009%): WB-DynaRes 16 Ultra

WB-DynaRes 8 Ultra

18 Bits (0.0004%): WB-DynaRes 16

WB-DynaRes 8

Maximum Speed

1700 Hz: WB-DynaRes 16

WB-DynaRes 8

900 Hz: WB-DynaRes 16 Ultra

WB-DynaRes 8 Ultra

All Models Feature

8 or 16 Digital I/O lines, user configurable · Six voltage input ranges · High noise rejection integrating converter · Dynamic resolution · Input protection to 50 Volts continuous, 150 Volts momentary · Wide acceptance of sensor devices · On-board counter/timer · Software linearization for RTDs and thermocouples · Factory guaranteed accuracy for two years from date of purchase

Chapter 1: Introduction to the WB-DynaRes

Thank you for selecting the WB-DynaRes board for your project!

Our primary objective is to provide you with data acquisition systems that are easy to install, operate, and maintain. We also strive to furnish the performance you need at the lowest overall cost. The benefits for you are increased productivity, data you can count on, and, of course, meeting your budget.

We manufacture the WB-DynaRes as an enhancement board that readily mounts in an expansion slot in an IBM PC, or -compatible, computer.

This product's high noise rejection, its input protection to withstand as much as 150 Volts, and its guaranteed long term stability make it ideal both for the laboratory and for harsh industrial environments.

Using the WB-DynaRes board together with our graphical interface application software (such as WorkBench PC, or QuickLog PC), you can easily and very quickly implement a broad spectrum of research and commercial tasks, in a wide variety of settings. You can, for example,

- · **Display and log data** *to disk for later analysis,*
- · **Measure temperature, pressure, flow** *and most other analog inputs from sensors and instruments,*
- · **Perform scale, offset, or complex calculations** *on a measurement,*
- · **Monitor and control processes***,*
- · **Set alarm limits** *on any input,*
- · **Control devices at preset levels** *(fans, pumps, heaters, etc.),*
- · **Control devices from digital input** *(e. g., from switches or TTL signals), and*
- · **Gather data unattended***.*

You can use the system interactively, operating controls or modifying your setup while the system is running.

DEVELOPMENT SYSTEM People who decide, on the other hand, to write their own software (rather than using an off-the-shelf application) can employ the Analog Connection Development System hardware driver to address all features of the WB-DynaRes board from within a program they design and code for their specific purpose.

EXPANDABILITY A WB-DynaRes product, depending on the model, has either eight or 16 differential analog input channels; and you can add one board at a time to your computer, up to as many as 15 boards, with a total of 240 analog input channels and 240 digital input/output lines!

RANGES/ UNITS OF MEASURE The six input ranges of the WB-DynaRes span from 25 milliVolts through 10 Volts, capable of accepting data from almost any sensor. Its high accuracy also makes the WB-DynaRes ideal for precise measurement in the laboratory.

The WB-DynaRes together with our software – such as Work-Bench PC and QuickLog PC – make it easy to specify engineering units (degrees, Volts, milliAmperes, etc.) for measurements, as well as which ranges to use.

You can measure temperature, for example, by selecting from among 11 different thermocouple types, or from a wide variety of resistance temperature detectors – RTDs. With our application software, the process simply consists of selecting the type of sensing device from a menu – the driver automatically handles cold junction compensation and linearization.

DATA PRESENTATION The combination of our hardware and application software (WorkBench PC or QuickLog PC) enables both the display of data on the screen, and the logging of data to disk for later analysis.

The system is capable of showing data on the monitor in a variety of formats, including graphical meters. Charts can indicate trends for comparison of actual measurements on several channels, or for setting data points or alarms.

DYNAMIC RESOLUTION Your WB-DynaRes incorporates "Dynamic Resolution," improving the board's accuracy.

With this feature, resolution is greater at the lower (negative) end of any range than at the higher end. As your readings approach the low end of any given range, the resolution becomes finer (that is, the increments of the signal you can distinguish become smaller).

This feature allows you to obtain the same advantages of an integrating converter, with the speed of a sample and hold converter, but without its susceptibility to noise.

Dynamic resolution gives a resolution that is a fixed percentage of the input voltage (not full scale voltage) down to about 10% of full scale. Our products, consequently, are the best available for taking accurate measurements of low-level signals, as you would using a thermocouple sensor.

Dynamic resolution is always best toward the negative end of any range:

Dynamic Resolution for Dissimilar Ranges –
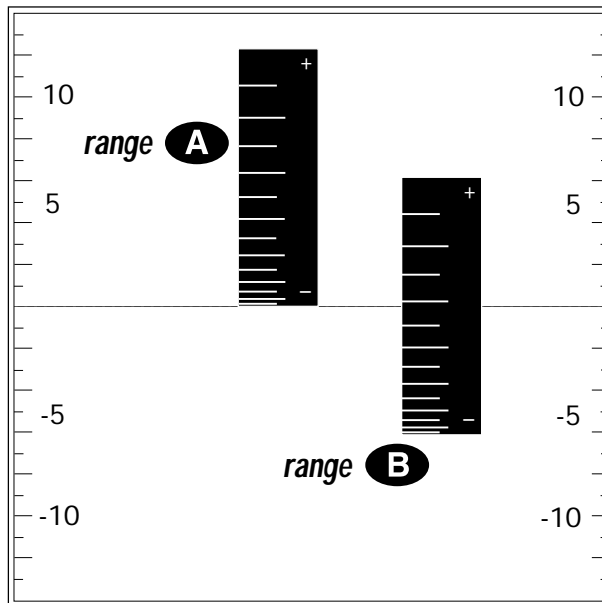
Two vertical black "rulers" (range **A** and range **B**) portray the impact of Dynamic Resolution. Their graduations – representing their ability to resolve – are always finer at the lower (more negative) ends of their ranges, regardless of the spectrum of values the ranges are measuring.

Features and Configurations

The WB-DynaRes line consists of two models: the WB-DynaRes 8/16 (capable of 12 bit resolution; that is, 0.024% of full scale), and the WB-DynaRes 8/16 Ultra (that can attain 16 bit resolution, or 0.0015% of full scale).

ANALOG INPUT CHANNELS A WB-DynaRes board can have two possible analog input configurations, also depending on the model of the product: The WB-DynaRes 8 and the WB-DynaRes 8 Ultra feature eight differential analog inputs, and the WB-DynaRes 16 and WB-DynaRes 16 Ultra models offer 16 differential analog inputs.

RESOLUTION SELECTIONS The resolution of your WB-DynaRes is selectable in software, ranging from 10 through 12 bits for the WB-DynaRes 8/16, and from 12 through 16 bits for the WB-DynaRes 8/16 Ultra.

(The WB-DynaRes also features advanced "dynamic resolution." See page 1 – 2 for further explanation.)

DATA ACQUISITION SPEED Maximum acquisition rates for the WB-DynaRes 8/16 range up to 1700 Hz, while the WB-DynaRes 8/16 Ultra is capable of reading data up to 900 Hz.

RANGES WB-DynaRes products have six voltage ranges, all selectable individually for each analog input channel.

NOISE REJECTION All WB-DynaRes models feature a high noise rejection integrating converter (in "low noise mode" it helps reject 50/60 Hz AC power line interference).

SENSORS Each WB-DynaRes provides accurate cold junction compensation and linearization for thermocouple devices, and signal conditioning for resistance temperature detectors (RTDs).

ACCURACY We guarantee the factory calibration of the WB-DynaRes for a period of two years from the date of purchase. (If it is ever necessary, the user can recalibrate the board with precision through the use of software utilities we provide with every product.)

INPUT PROTECTION Built-in circuitry assures protection of analog input channels for 50 Volts, continuous , or 150 Volts, momentary.

DIGITAL I/O There are 8 digital input/output channels on the WB-DynaRes 8 and WB-DynaRes 8 Ultra models; 16 digital I/Os are available on the WB-DynaRes 16 and WB-DynaRes 16 Ultra.

COUNTER/TIMER Every WB-DynaRes board includes a counter/timer for precise timing (for counting pulses or other events) which you can also

use as a pulse output. (*NOTE: If you are using WorkBench PC for Windows, the counter/timer of the first board installed will not be available for use.*)

TERMINAL PANELS Available accessories for the WB-DynaRes include your choice of screw terminal panels for connecting sensors. They include general purpose, thermocouple, and resistance temperature detector (RTD) device terminal panels, all of which accept digital opto-isolators.

FOR MORE INFORMATION For more information about the capabilities of your WB-DynaRes, please see "Product Specifications" in Chapter 3.

For instructions on controlling the board with our interface software (such as WorkBench PC or QuickLog PC), refer to the appropriate software manual.

To learn more about data acquisition and process control in general, and how to use our products together to accomplish everyday tasks, consult our *Applications* manual.

And, last but not least, if you're creating your own program to address the WB-DynaRes for a custom purpose, please see the *Analog Connection Development System Manual.*

DYNARES SYSTEM REQUIREMENTS Before installing the WB-DynaRes, make sure the computer system fulfills these minimum requirements:

Hardware –

·   **IBM PC XT, AT, (or higher), or -compatible**, with at least 640k system RAM and full-size slot,

·   **3.5" Floppy disk drive** and a hard drive.

Software Environment –

·   **DOS 3.0** *(or higher, depending on the application software),*

·   **Application software** *(WorkBench PC, QuickLog PC, the Analog Connection Development System, or other compatible proprietary software; please see your software manual for directions for using it with the hardware).*

Chapter 2: Installing the WB-DynaRes

Getting your WB-DynaRes data acquisition and process control board up and running is a straightforward process; you only need to:

· **Verify the board's switch settings** *that control board identity and system addressing (see page 2 – 2),*

· **Physically insert the board** *into a slot of the personal computer (page 2 – 4; and illustration on 2 – 3),*

· **Connect a terminal panel to the board** *(to attach sensing devices and for digital outputs from the WB-DynaRes; see page 2 – 4), and*

· **Load and start up the software** *to be used for the project.*

As the scope of this manual focuses on the WB-DynaRes board, this chapter discusses board's switch settings, and the physical insertion of the board.

Please see your terminal panel manual for full instructions regarding its attachment to the WB-DynaRes, as well as for how to connect sensors to the panel.

Guidelines for loading the software, and for starting up, depend on the application program you are going to use (such as our WorkBench PC for Windows or DOS, or QuickLog PC, or a package by a third party developer who has our authorization).

The program you are going to use with the WB-DynaRes might even be unique and proprietary, a product of your organization. (The Analog Connection Development System is a powerful set of utilities making it possible for software engineers to design and develop their own programs to exploit the WB-DynaRes' many features.)

In any event, please refer to the software provider's installation manual, or user guide, for specific information on how to load and run the particular program.

Troubleshooting – If you have any difficulty getting your board to work, refer to the "Troubleshooting" section in Chapter 3.

Verifying WB-DynaRes Switch Settings

SINGLE BOARD When you purchase a data acquisition board new from our company, the product's switch settings already are correct to operate a *single* board with our software (WorkBench PC, QuickLog PC, the Analog Connection Development System, and all others).

This means the factory switch settings are right for the purpose of using only one board, and you can skip the task of confirming them. You can go directly to the "Physical Board Installation" section on page 2 – 4 in this chapter, and begin to follow the steps there.

MULTIPLE BOARDS If you are using more than one board at a time, set the individual boards' Board Number Switch first (refer to "Setting the Board Number Switch" on page 2 – 6), then go on to perform the physical installation.
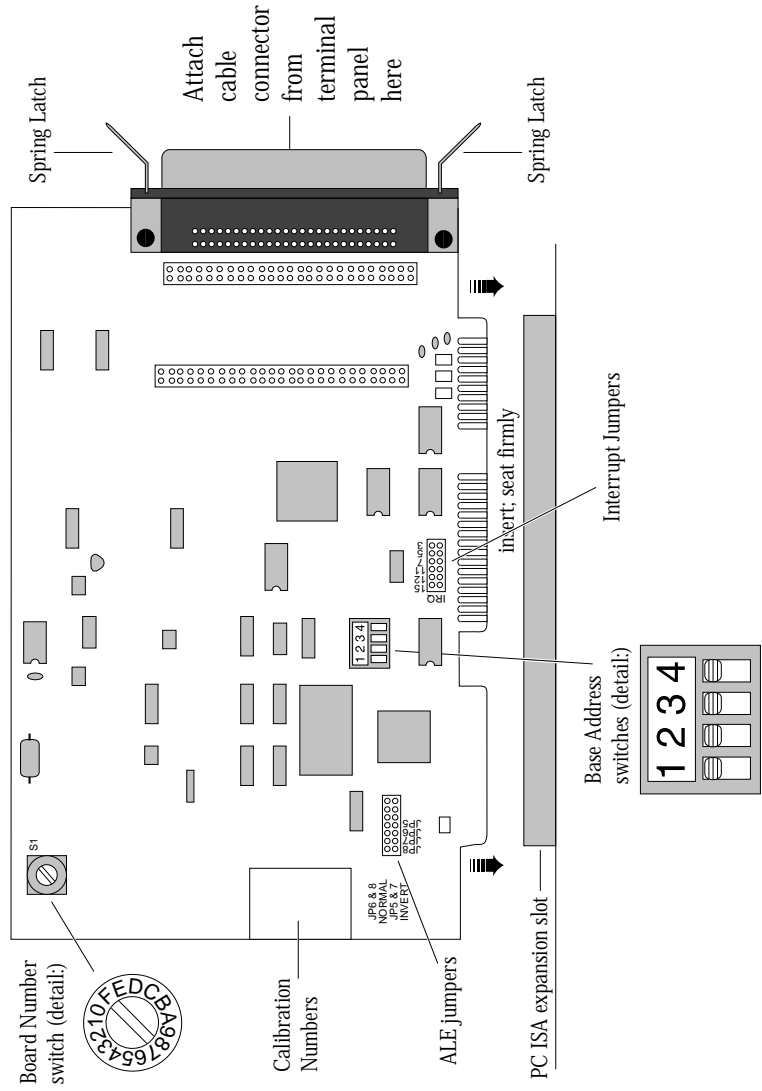
Otherwise, there's no reason to be concerned about the board's switch settings, except in the unlikely event you encounter a problem in getting your product to operate. (If you experience a problem, refer to "Troubleshooting" in Chapter 3).

PREVIOUSLY IN USE If, on the other hand, your board has been in use previously in another computer, or if your company uses its own proprietary software, the present switch positions might differ from the factory settings.

If your company uses such a program, making changes to factory switch settings might be necessary to accommodate it. Please consult the administrator of your internal system, or the provider of third party software, to determine their recommendations for any unusual switch setting.

To check and restore the factory values, please read "Board Number Switch Settings" on 2 – 6 in this chapter.

Illustration of WB-DynaRes Data Acquisition Board, Showing Physical Installation –

Attach cable connector from terminal panel here

Spring Latch

Spring Latch

insert; seat firmly

Interrupt Jumpers

Base Address switches (detail:)

1 2 3 4

Board Number switch (detail:)

S1

FEDCBA9876543210

Calibration Numbers

ALE jumpers

JP6 & 8 NORMAL
JP5 & 7 INVERT

PC ISA expansion slot

Physical Board Installation

Installation very simply consists of inserting the board into an open peripheral (expansion) slot inside your computer.

(There are, for example, five available slots in the IBM PC, and eight in the IBM XT or AT. IBM and other companies sell expansion chassis that can accept even more analog cards. Our software supports as many as 15 boards at one time.)

TERMINAL PANEL CONNECTIONS When using a terminal panel with the WB-DynaRes (to connect external devices: sensors and digital input/output) you are going to use the provided Centronics cable.

Each cable can conduct eight analog input channels and eight digital I/O lines from your WB-DynaRes to a single terminal panel.

One Terminal Panel, One Cable – A WB-DynaRes 8 or WB-DynaRes 8 Ultra, using eight analog input channels, requires one Centronics cable for connection to one terminal panel (this also allows the use of eight digital I/O lines).

Two Terminal Panels, Two Cables – A WB-DynaRes 16 or WB-DynaRes 16 Ultra, using 16 analog input channels, requires two Centronics cables for connection to two terminal panels (to handle two "banks" of eight analog inputs: Analog Input Channels 1-8, and Analog Input Channels 9-16).

(Refer to "Pinouts," in Chapter 3 of this manual, for a description of the signals at the connectors.)

PHYSICAL INSTALLATION ***To Install the WB-DynaRes Board –***

1. ***TURN THE COMPUTER OFF!*** Never remove the cover of the computer without first turning the power switch off.

2. ***Open the Computer*** Remove the cover of the computer. (If appropriate, refer to your computer's owner's manual for more information about removing the cover and installing enhancement boards.)

3. ***Ground Yourself*** While holding the board, before installing it, touch the metal chassis of the computer to discharge any static electricity that might be on the surface of your body.

   This is important, as static electricity can damage electronic

parts. (Likewise, if you ever remove the board from the computer, always store it in its protective shipping bag.)

4. **Remove Plate** At the back panel of the computer, unscrew and remove the narrow dust cover plate that is directly behind the expansion slot you want to use. (Keep this screw handy.)

5. **Insert the Board** Push the edge of the WB-DynaRes board having "gold fingers" down and into the expansion slot (socket) on the chassis, making sure that the contacts align with the socket and the spring latches are through the socket. Then plug it in by pushing the board straight down. *(NOTE: If you are using a WB-DynaRes 16 or WB-DynaRes 16 Ultra, a second expansion slot is required for the second cable connector.)*

6. **Fasten the Board to the Chassis** Install the "left over" screw from step 4. Place it in the original hole, through the WB-DynaRes board's bracket, so that it fastens the top of the bracket to the computer's back panel.

7. **Connect the Cable to the Terminal Panel** Plug the cable's connector into the socket on the terminal panel (please refer to your terminal panel's manual, if you are unsure about the correct position).

CAUTION Incorrect installation of these cables can damage the data acquisition board or the terminal panel. If you are uncertain about proper placement, please see "Terminal Panel Connections" at the beginning of this discussion, and inspect the diagram on page 2 – 3 .)

NEXT STEPS **IMPORTANT! Measuring Current –** If you are going to measure current, please see "Measuring Current" on the next page.

Single Board Usage – If you intend to run with a single data acquisition board in your system, you are now ready to install your application software and to connect sensors to your terminal panel.

Multiple Board Usage – If you are going to use more than one data acquisition board, now it's time to set each Board Number Switch to an unique number. Follow the steps in the "Setting the Board Number Switch" section in this chapter on page 2 – 6.

Installing the Software – For information on loading and configuring our WorkBench PC for Windows or DOS or QuickLog PC please refer to the user guide for that application package.

Installing the Terminal Panels – To learn how to connect experiments to the terminal panel see your terminal panel owner's manual, or our *Applications* manual (which discusses data acquisition and control in general and provides examples of uses for the products).

Measuring Current

If you are going to connect a current, rather than a voltage, to one or more of the analog input channels, then make certain to set the "Current/Volt" switch for that channel on the terminal panel. These switches are located under the daughterboard on the WB-T71 terminal panel *(see Terminal Panels manual for illustration).*

Moving a switch to the "Current" position selects current, placing a precision 24.9Ω, 0.1% resistor in the circuit for that channel.

CAUTION Two kinds of misuse can burn out the board's input sense resistors:

Do not apply a voltage to a channel whose setting is for current.

Also, do not apply more than 50 mA to a channel set for current.

Setting the Board Number Switch

MULTIPLE BOARDS When you are using multiple boards in your installation, each board needs to have an identity for the software to recognize it as an "individual."

The Board Number switch on a board accomplishes this, as it enables you to set an identifying number for the board (see the illustration on page 2 – 3).

This number determines, among other things, the sequence in which the software reads multiple boards (OMEGA programs can address as many as 15 boards).

When using more than one WB Series product in your installation, every board's Board Number switch needs to have a different

number setting, and all switches are to be in number sequence, starting with 1. For example, if you are using three boards, the board number sequence would be 1, 2, 3.

(If there are also WB-Flash-12 or WB-WorkMate boards in your installation, and you are using DOS software, then their Board Numbers need to be at the high end of the number sequence.)

SINGLE BOARD If your system includes just a single data acquisition board, then you don't need to have much concern about the Board Number switch.

When your WB-DynaRes leaves our manufacturing facility, we set the Board Number switch to 1, and this is the setting we recommend for most purposes when you are using only one board in your installation.

DISABLING BOARDS If you want to disable the board, for any reason, set its Board Number switch to 0. This is handy if you want to use fewer boards for a while: that way you don't have to remove them from the computer. Remember, however, that all remaining boards must have their board numbers in a continuous sequence.

SETTING THE SWITCH *To Set the Board Number Switch –*

1. *Locate the Switch* With the cover of your computer removed, examine the illustration on page 2 – 3 in this chapter and find the "Board Number Switch" on the WB-DynaRes.

   On the printed circuit board, this is a rotary switch with the label "BRD SEL."

2. *Make the Setting* Note that the switch has 16 possible positions: numbers on the detents are 0 through 9 and A through F.

   Determine which is to be the First Board. (This is easy, if it is the sole board.) Then turn its dial to 1.

   Determine which is to be the Second Board, then set its switch to 2.

   Continue to set the switches for all boards in your installation to unique numerical values in an unbroken sequence.

   (As various models of our boards use different kinds of switches, please see their owner's manuals for an explanation of how to set switches on other boards.)

Setting the Base Address

The Base Address determines the logical system address where the personal computer expects to find all data acquisition boards. Base Addresses must be the <u>same</u> on all boards.

The factory setting for all of our data acquisition products is 300H (in hexadecimal format).

It is rarely necessary, but if you have difficulty getting the board to work you can change these switches to values different from the factory settings. (Another device in your PC, for example, might be trying to use the same Base Address.)

Indications of this are: if the program reports it cannot find your board, or if it reports fewer boards than you really have, or if another board starts to work improperly after you install the WB-DynaRes.

These problems indicate interference with another board using the same base address as the WB-DynaRes product.

Remedy the problem by changing the switches of all data acquisition boards to an address that has no conflict. (If you have boards other than WB-DynaRes in your system, please refer to their owner's manuals for instructions on how to change their setttings.)

SETTING WB-DYNARES BASE ADDRESS

To Set the Base Address –

1. **Locate the Address Switches** Remove the cover of your computer over the data acquisition board, and find the location of the Base Address switches. Refer to the board illustration on page 2 – 3 in this chapter and find "Base Address Switches" on the WB-DynaRes diagram.

   On the printed circuit board itself, this is a block of four DIP switches.

   (NOTE: Depending on the space available in your installation, it might be necessary to remove the board to reach the Base Address Switches. If so, please follow the same precautions as in "Physical Installation" on page 2 – 4.)

2. **Change the Setting** 300H is the normal base address. It consists of all four DIP switches' being in the "up" position (when the board is sitting in the computer's expansion slot).

The DIP switches have the labels "1" through "4." Sliding a switch to the "down" position *adds* a value to 300H:

WB-DynaRes Base Address Switch Additive* Values –

Switch	Position	To 300H Add
1	Down	10H
2	Down	20H
3	Down	40H
4	Down	80H

* As the switches are additive, your sliding
   Switches 1 and 4 down, for example, is going to
   add 10H and 80H to the 300H, equalling 390H.

BASE ADDRESS SETTINGS

Possible WB-DynaRes Base Address Settings –

Value	Switch Positions* 1	2	3	4	Comments
300H	U	U	U	U	*Factory setting*
310H	D	U	U	U	–
320H	U	D	U	U	*May interfere with hard disk drive*
330H	D	D	U	U	–
340H	U	U	D	U	*Recommended alternative*
350H	D	U	D	U	–
360H	U	D	D	U	–
370H	D	D	D	U	*May interfere with parallel printer*
380H	U	U	U	D	–
390H	D	U	U	D	–
3A0H	U	D	U	D	–
3B0H	D	D	U	D	–
3C0H	U	U	D	D	–
3D0H	D	U	D	D	*May interfere with graphics adaptor*
3E0H	U	D	D	D	–
3F0H	D	D	D	D	*May interfere with floppy disk drive*

* U = Up   D = Down

Changing Hardware Interrupts

For users of Windows programs that employ hardware interrupts, the WB-DynaRes board provides for changing the interrupt number, if necessary.

Refer to page 2 – 3 to locate the interrupt jumper block on the WB-DynaRes board. By repositioning the jumper, which is a plug, to another socket on the block, you can select another of these interrupts: IRQ2, IRQ5, IRQ7, IRQ11, IRQ12, or IRQ15. (Remember that on AT computers the IRQ2 selection is actually the IRQ9 line.)
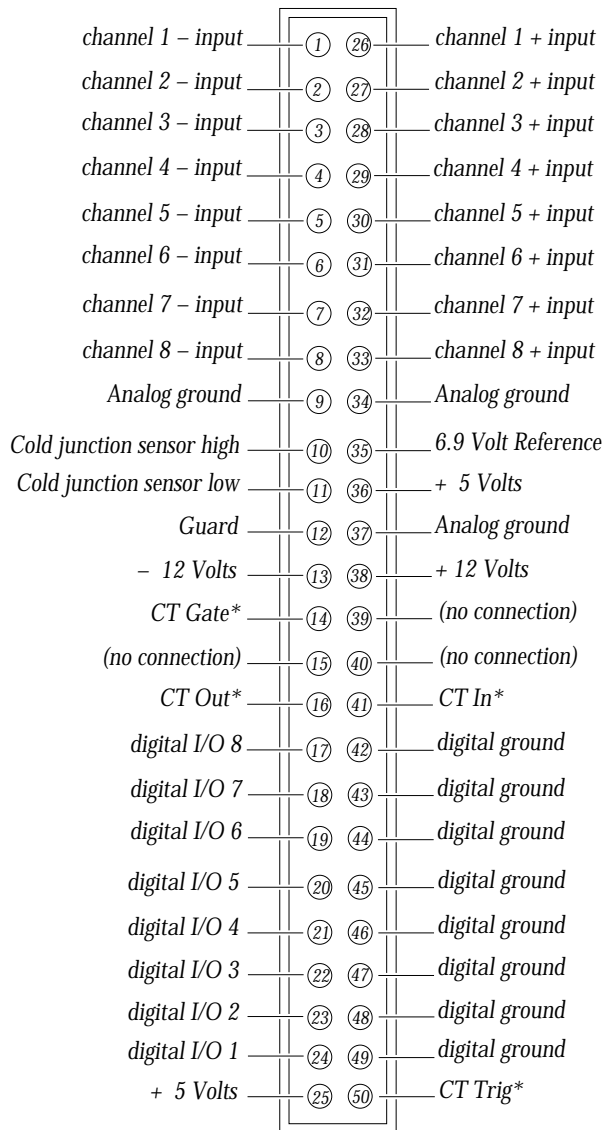
Chapter 3: Technical Notes

Although operations in this chapter are seldom necessary during everyday data acquisition, you might want to refer to them at certain times during operation of the WB-DynaRes. They are
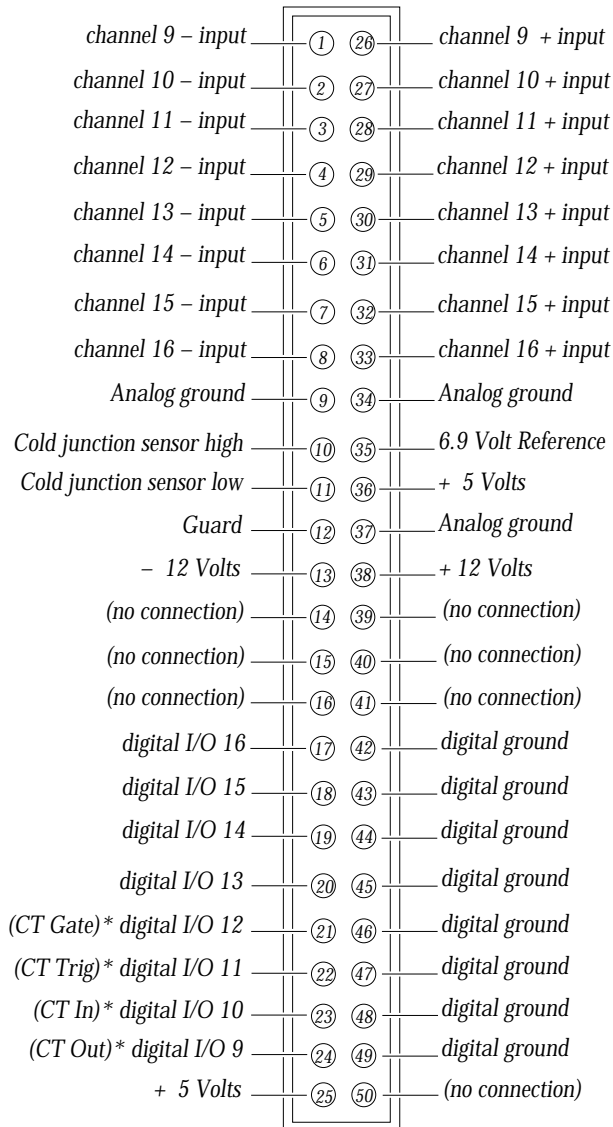
- · **Pinouts** *(at the board's connectors in the event you want to connect analog or digital signals directly, without using a terminal panel; please refer to pages 3 – 2);*

- · **Block diagram** *of the WB-DynaRes showing on-board processing (please see page 3 – 4);*

- · **Recalibration** *of all WB-DynaRes on-board references to bring the accuracy of the product to factory specifications (see page 3 – 5);*

- · **Using EDITCAL** *to edit calibration files on EEPROM to accommodate changes to your installation, or to restore missing files (on page 3 – 6);*

- · **Note for DOS users** *with respect to the Analog Connection Development System (please see page 3 – 6);*

- · **Troubleshooting**: *some possible problems and solutions after installing, and during operation of the WB-DynaRes (starting on page 3 – 7).*

Pinouts of the WB-DynaRes 8, WB-DynaRes 8 Ultra, and Channels 1–8 on the WB-DynaRes 16 and WB-DynaRes 16 Ultra (at Back Panel Connector) –

| Left	Pin	Pin	Right
channel 1 – input	①	㉖	channel 1 + input
channel 2 – input	②	㉗	channel 2 + input
channel 3 – input	③	㉘	channel 3 + input
channel 4 – input	④	㉙	channel 4 + input
channel 5 – input	⑤	㉚	channel 5 + input
channel 6 – input	⑥	㉛	channel 6 + input
channel 7 – input	⑦	㉜	channel 7 + input
channel 8 – input	⑧	㉝	channel 8 + input
Analog ground	⑨	㉞	Analog ground
Cold junction sensor high	⑩	㉟	6.9 Volt Reference
Cold junction sensor low	⑪	㊱	+ 5 Volts
Guard	⑫	㊲	Analog ground
– 12 Volts	⑬	㊳	+ 12 Volts
CT Gate*	⑭	㊴	(no connection)
(no connection)	⑮	㊵	(no connection)
CT Out*	⑯	㊶	CT In*
digital I/O 8	⑰	㊷	digital ground
digital I/O 7	⑱	㊸	digital ground
digital I/O 6	⑲	㊹	digital ground
digital I/O 5	⑳	㊺	digital ground
digital I/O 4	㉑	㊻	digital ground
digital I/O 3	㉒	㊼	digital ground
digital I/O 2	㉓	㊽	digital ground
digital I/O 1	㉔	㊾	digital ground
+ 5 Volts	㉕	㊿	CT Trig*

** **Note:** When two terminal panels are used, the one spare counter/timer on the board can be accessed from both terminal panels. Access to the CT lines is through pins 14, 16, 41, and 50 on Terminal Panel 1 or through pins 21–24 on Terminal Panel 2 (pins 14, 16, 41, and 50 will have no connection on this panel). If one of these CT lines is used, then that pin number on the other terminal panel cannot be used.*

Pinouts of Channels 9–16 on the WB-DynaRes 16 and WB-DynaRes 16 Ultra (at Back Panel Connector) –

channel 9 – input	① ㉖	channel 9 + input
channel 10 – input	② ㉗	channel 10 + input
channel 11 – input	③ ㉘	channel 11 + input
channel 12 – input	④ ㉙	channel 12 + input
channel 13 – input	⑤ ㉚	channel 13 + input
channel 14 – input	⑥ ㉛	channel 14 + input
channel 15 – input	⑦ ㉜	channel 15 + input
channel 16 – input	⑧ ㉝	channel 16 + input
Analog ground	⑨ ㉞	Analog ground
Cold junction sensor high	⑩ ㉟	6.9 Volt Reference
Cold junction sensor low	⑪ ㊱	+ 5 Volts
Guard	⑫ ㊲	Analog ground
– 12 Volts	⑬ ㊳	+ 12 Volts
(no connection)	⑭ ㊴	(no connection)
(no connection)	⑮ ㊵	(no connection)
(no connection)	⑯ ㊶	(no connection)
digital I/O 16	⑰ ㊷	digital ground
digital I/O 15	⑱ ㊸	digital ground
digital I/O 14	⑲ ㊹	digital ground
digital I/O 13	⑳ ㊺	digital ground
(CT Gate)* digital I/O 12	㉑ ㊻	digital ground
(CT Trig)* digital I/O 11	㉒ ㊼	digital ground
(CT In)* digital I/O 10	㉓ ㊽	digital ground
(CT Out)* digital I/O 9	㉔ ㊾	digital ground
+ 5 Volts	㉕ ㊿	(no connection)

** **Note:** See the note on counter/timer lines on page 3-2.*

Block Diagram of the WB-DynaRes (All Models) –
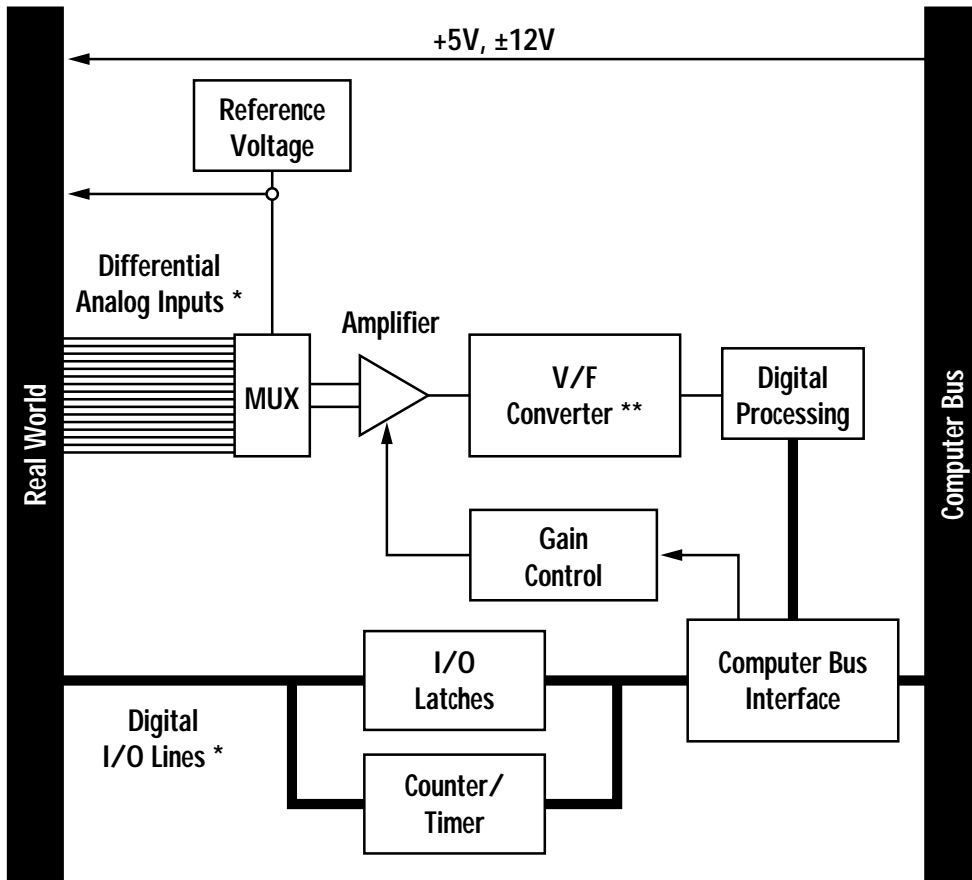
* Analog Inputs and Digital I/Os: *8 channels for WB-DynaRes 8*
and WB-DynaRes 8 Ultra
16 channels for WB-DynaRes 16
and WB-DynaRes 16 Ultra

** V/F Converter: *12 bits for WB-DynaRes 8*
and WB-DynaRes 16
16 bits for WB-DynaRes 8 Ultra
and WB-DynaRes 16 Ultra

Recalibration

Your WB-DynaRes uses an exclusive calibration technology to achieve great stability, requiring no adjustment for years. (As a reflection of this, we guarantee the factory tolerances for two years from the date of purchase.)

FACTORY METHODS Instead of employing adjustment potentiometers to calibrate the board, our technicians test and calibrate each WB-DynaRes after assembly. They then enter that board's unique calibration number values into EEPROMs on the board; we also print the same numbers on a label on the board itself.

Whenever you use our software with the board thereafter, the programs read the factory's calibration numbers from the EEPROM, and automatically make minor compensations for real-world conditions (for instance, for cold junction properties of a thermocouple).

RECALIBRATION Under normal conditions, no full recalibration of the WB-DynaRes is necessary.

(If you ever suspect that your WB-DynaRes is out of tolerance, please call Technical Support for advice. If it requires recalibration, we can perform the work for you at our facility using the same high accuracy test equipment we use during the manufacturing quality assurance process.)

A Note About RECAL.EXE – One of the utility programs we distribute on the QuickLog PC disk, RECAL.EXE, is for the purpose of completely recalibrating our data acquisition boards. This software, however, is only suitable for use in a comprehensive hardware lab, and requires sophisticated test equipment.

(Successful use of RECAL.EXE requires, for example, a precision DC voltage supply, as well as a digital volt meter having 0.005% accuracy.)

Only if your organization is proficient in such techniques, and only if you have the necessary equipment, do we encourage you to proceed with recalibration (and please contact our Technical Support Department for guidelines).

For most customers, we recommend returning the board to our Technical Services Department, instead.

EDITCAL Utility

EDITCAL.EXE (or EDITCAL, for short) is the utility program that simplifies the modification of values in the EEPROM.

STARTING Make sure the EDITCAL.EXE program file is in the same sub-
EDITCAL directory as the application programs.

To Start Up EDITCAL.EXE –

 1. At the DOS prompt, enter **EDITCAL**, then press the **[ENTER]** key. (This invokes the utility.)

EDITCAL *To Select a Function –*
SELECTIONS

 1. Use the arrow keys to navigate back and forth among these menu selections:

 DATA FILES *To merge calibration files supplied from the factory into a single file for systems that have multiple boards, or to update existing calibration file (not for use with WB-DynaRes boards).*

 AC EEPROM *To view or modify calibration data on Analog Connection boards (including WB-DynaRes boards) that have non-volatile on-board EEPROMS.*

 HS EEPROMS *To view or modify calibration data on high speed boards EEPROM, such as WB-WorkMate or WB-Flash 12.*

 DS EEPROM *To view or modify calibration data on DATAshuttles' EEPROMS.*

 QUIT *Ends this EDITCAL session.*

 2. Move the arrow keys until the selection you want is flashing.
 3. Press **[ENTER]**.

Note on the AC Development System

For those DOS users utilizing our Analog Connection Development System: The WB-DynaRes boards respond identically to the WB-FAI/AAI series of boards, except the card type returned by the "b" command is "3" instead of "0."

Troubleshooting: Installation

If you experience difficulty in getting your data acquisition board up and running, please check to see that the installation is according to the descriptions in Chapter 2.

If the software reports a board failure, or that it cannot find a board, then try these remedies:

1. Confirm that the board is seated properly in the PC expansion slot (reseat it, if necessary; see the illustration on page 2 – 3).

2. Verify the Board Number switch is *not* set to "0." (See page 2 – 6).

3. Use a different Base Address. It is possible that another device in your installation is trying to use the same Base Address (see the explanation on page 2 – 8). You may optionally specify this new number in the STI_DRV.INI.

4. If there is more than one data acquisition board in your installation, make sure they all have the *same* Base Address, but *different* Board Numbers.

5. Install the board in another open slot in the PC (follow the instructions on page 2 – 4).

6. Remove other devices from expansion slots in your PC to check whether or not they are conflicting with your WB-DynaRes board.

7. Verify that the software is up to date (a version compatible with the board you are using. Contact us, or your software provider).

8. Try different IRQ levels. If you are operating under our Windows software, change the IRQ level on the jumpers on your data acquisition board (see illustration on page 2 – 3 to locate these jumpers). You may want to specify this new number in your STI_DRV.INI file. Alternatively, you may change the IRQ levels of other hardware in your computer.

9. Remove other software drivers that may conflict with ours.

10. If possible, install the board in another computer to verify its correct operation.

11. *Try alternate bus timing jumpers.* On some models of computers, the Address Latch Enable (ALE) timing is not compatible with our data acquisition boards.

To try the alternate (falling edge) timing, locate jumpers JP5 through JP8 on the data acquisition board. The normal (rising edge) timing position is JP6 and JP8. To change this, you need to cut these traces with a sharp knife, then solder a wire across JP5 and JP7.

(NOTE: This alternate connection may not work in all models of computers.)

(Please call our Technical Support line before returning a board – we hope to assist you with your problem via telephone.)

Troubleshooting: Operation

HINTS During operation, it's good practice to short all analog input channels you're not using; to do this, connect + to – to Com.

It's essential to have exactly one ground reference per channel. This single connection to ground makes sure you don't exceed the common mode range of input.

(More than one connection per channel can lead to ground loops, causing errors or erratic readings. Connecting the – to the Com terminal provides a single ground. Your sensor might also provide another ground. If you're not sure that your sensor is grounded, try connecting the – to Com, and not, and see which works best.)

Remember that if speed is not critical, selecting the "low noise mode" in software always provides the best accuracy and resolution with your data acquisition board.

OPERATING Qs AND As Here are mini "case studies" of difficulties, along with some easy solutions:

Problem: **My board reads analog inputs wrong.**

Action: Make sure the calibration numbers in the EEPROM are correct *(see the discussion beginning on page 3 – 6 in this*

chapter). If the figures are correct, try shorting + to – to Com: the board should return a reading around 0V.

Problem: **My board reads the thermocouple as a very negative temperature.**

Action: Verify the connections are secure. Opens read as negative temperature.

Problem: **My board reads thermocouple input wrong.**

Action: Confirm that the CCAL number in the EEPROM matches the number on the terminal panel's calibration label.

(If you need to use a general purpose terminal panel – one that doesn't have a factory CCAL number – with a thermocouple, you can achieve approximate results by entering a CCAL of 2300. Then change the figure by about 75 points for each degree C. that you want to raise the temperature.)

Problem: **My readings are noisy.**

Action: Try using the low noise mode (see your software manual for more information).

Problem: **My board used to work, but now the software cannot find it, or reports an error.**

Action: Check to make sure the Board Number switch is not set to "0."

IF YOU NEED CUSTOMER SUPPORT

What to do before calling technical support, to help us serve you better:

1. Have the part numbers of your boards and terminal panels ready.

2. Have the type and version number of the software you're using.

3. Have your computer's type, model, and the version of the operating system.

Specifications of the WB-DynaRes 8 Ultra and WB-DynaRes 16 Ultra:

ACCURACY *WB-DYNARES 8/16 ULTRA GENERAL CONDITIONS ACCURACY –*

	Range	Typical Resolution at Full Scale	Absolute Accuracy, the Larger of	
			% of Range:	% of Reading:
VOLTAGE	-5 to +50 mV	0.8 μV	0.04%	–
	-25 to +25mV	0.8 μV	0.08%	–
	-50 to +500mV	8 μV	0.01%	0.05%
	-250 to +250 mV	8 μV	0.01%	0.05%
	-1 to +10 V	150 μV	0.01%	0.05%
	-5 to +5 V	150 μV	0.01%	0.10%

General Conditions – From 15 to 35 degrees C. ambient at the interface board, source resistance less than 1k Ohms. Includes linearity, drift, offset, resolution, and calibration error. 16 bit (0.0015%) resolution in use.

Thermocouple Conditions – Same as General Conditions. Does not include the accuracy of the thermocouple itself (cold junction error must be added in; cold junction compensation with T21 terminal panel only; please see your terminal panel manual's specifications for cold junction compensation error). Resolution assumes 16 bit resolution in use; it is approximate because resolution varies with temperature.

Thermocouples use the 50 mV range. For inputs below -5 mV (below approximately -100 degrees C.) use the +/-25 mV range. For the best resolution use the 50 mV range above -5 mV.

WB-DYNARES 8/16 ULTRA THERMOCOUPLE ACCURACY –

Type	Range (°C.)	Resolution (°C.)	Accuracy (°C.)
J	-210 to -100	0.02 – 0.04	± 1.2
	-100 to 100	0.02	± 0.7
	100 to 880	0.01	± 0.5
K	-250 to -150	0.03 – 0.15	± 4
	-150 to -50	0.03	± 1
	-50 to 1260	0.02	± 0.7
E	-250 to -100	0.08 – 0.01	± 2
	-100 to 200	0.01	± 0.6
	200 to 680	0.01	± 0.4
T	-250 to -120	0.03 – 0.1	± 3
	-120 to -25	0.02 – 0.03	± 0.9
	-25 to 200	0.01 – 0.02	± 0.7
	200 to 400	0.01	± 0.5
S	-50 to 50	0.1 – 0.2	± 5
	50 to 300	0.1	± 3
	300 to 1770	0.08	± 2
R	-50 to 25	0.1 – 0.2	± 5
	25 to 200	0.1	± 3
	200 to 1770	0.08	± 2
B	200 to 300	0.25 – 0.4	± 10
	300 to 500	0.15 – 0.25	± 6
	500 to 1000	0.08 – 0.15	± 4
	1000 to 1820	0.08	± 2
G	25 to 200	0.08 – 0.3	± 8
	200 to 2315	0.08	± 2
D	-20 to 2315	0.04 – 0.08	± 2
	300 to 1500	0.04	± 1.3
C	-20 to 2315	0.04 – 0.08	± 2
	100 to 1500	0.05	± 1.5
N	-200 to -100	0.05 – 0.1	± 3
	-100 to 1300	0.02 – 0.05	± 1.5

WB-DYNARES 8/16 ULTRA RTD ACCURACY –

Set Resistor Ω	RTD Ω	Range °C.	Resolution °C.	Accuracy °C.
10 k	50	-200 to 115	0.005	0.8
20 k	50	-200 to 525	0.01	0.9
20 k	100	-200 to 115	0.005	0.8
50 k	50	-200 to >850	0.03	1.4
50 k	100	-200 to 750	0.01	1.0
50 k	200	-200 to 115	0.005	0.8
100 k	100	-200 to >850	0.03	1.4
100 k	200	-200 to 750	0.01	1.0
100 k	500	-200 to 115	0.005	0.8
200 k	200	-200 to >850	0.03	1.4
200 k	500	-200 to 525	0.01	0.9
200 k	1000	-200 to 115	0.005	0.8
500 k	500	-200 to >850	0.03	1.4
500 k	1000	-200 to 750	0.01	1.0
1000 k	1000	-200 to >850	0.03	1.4

RTD Conditions – Same as General Conditions. Does not include the accuracy of the RTD sensor itself. Includes linearization and signal conditioning errors. Resolution assumes 16-bit resolution is in use. RTD measurements are on the 50 mV range.

STABILITY Accuracy specifications in this chapter already reflect these temperature drift errors for temperatures from 20° through 40° C.:

WB-DYNARES 8/16 ULTRA STABILITY –

Range	% per °C.	% Over a Year
50 mV	± 0.001	± 0.02
± 25mV	± 0.001	± 0.02
all other voltage ranges	± 0.0025	± 0.03

In many applications, stability and noise can be more important than absolute accuracy. This is "repeatability." Calculate the repeatability of a reading by adding together the stability and noise for the range you want.

INPUT IMPEDANCE The WB-DynaRes 8/16 Ultra has an input impedance of > 20 M Ω.

NOISE REJECTION *Important:* All noise measurements are in low noise mode.

CMRR – The Common Mode Rejection Ratio (CMRR) is >20 dB. Conditions for CMRR: DC to 400 Hz, common mode input ± 7.0 Volts channel to ground. This specification applies even when one or more nonmeasured channels exceeds the operating common mode range.

WB-DYNARES 8/16 ULTRA NOISE REJECTION –

Range	Typical Internal Noise (RMS)
50 mV	0.5 µV
± 25 mV	0.5 µV
500 mV	2.5 µV
± 250 mV	2.5 µV
10 V	50 µV
± 5 V	50 µV

COMMON MODE RANGE ***Operating, channel-to-ground –*** ±7 Volts

Nonoperating – 50 Volts continuous, 150 Volts for one second, nonrepetitive.

INPUT PROTECTION 50 Volts continuous. 150 Volts for one second, nonrepetitive.

RESOLUTION/ SCAN RATE Selectable in software:

WB-DYNARES 8/16 ULTRA RESOLUTION AND SCAN RATE* –

Resolution at Full Scale	Scan Rate
low noise mode: 0.0004%	45/55 Hz
16 bits: 0.0015%	200 Hz
15 bits: 0.003 %	300 Hz
14 bits: 0.006 %	500 Hz
13 bits: 0.012 %	700 Hz
12 bits: 0.024 %	900 Hz

* Rates describe an IBM PC 486DX2 66MHz running WorkBench PC for Windows under Windows 3.1 with Tolerate Error=0. Rates are somewhat faster in faster computers. Please also see "Dynamic Resolution" on page 1 – 2.

Scan rate is the rate in Hertz (or, samples per second) to read data into memory, including the time it takes to switch channels and ranges. To calculate the total scan time for all channels, divide the rate by the number of channels.

DIGITAL I/O CHANNELS The WB-DynaRes 8/16 Ultra has 8 or 16 digital I/O lines, with each line individually selectable as input or output. These channels are TTL- and MOS- compatible as they come out of the board.

Their outputs sinks are open collector and are 3 milliAmperes; as inputs they draw no current. (Please see the specifications in your terminal panel owner's manual for open collector output.)

COUNTER/TIMER The WB-DynaRes 8/16 Ultra has one on-board 16 bit counter/ timer with 2 MHz internal clock. The counter timer is connected to Digital I/O lines 9–12 on Terminal Panel 2 or to CT Gate, CT Out, CT In, and CT Trig on Terminal Panel 1.

GENERAL CONDITIONS *Maximum Voltage on any terminal –* 150V

Maximum Current on any terminal – 1A

Auxiliary Power Supplies – +5V, +12V, or -12V, direct from the computer's power supply. The +6.9V supply draws it's current from the +12V supply.

Voltage	Maximum Current
+6.9V	20mA
+12V	200mA
+5V	100mA
-12V	200mA

+6.9V Supply Tolerance – ± 5%

· *Temperature Coefficient: < 0.0005% per ºC*

· *Stability: < 0.01 per year*

Operating Temperature Ambient – 0 to 50 degrees Celsius.

Physical Dimensions– 6.7" x 4.0" (17.0cm x 10.2cm)

WB-DynaRes 8/16 Ultra Current Consumption* –

Voltage	Supply Current Consumed by	
	WB-DynaRes 8 Ultra:	WB-DynaRes 16 Ultra:
+5V	317mA	335mA
+12V	10.5mA	13mA
-12V	1.6mA	2.5mA
Total	1.73 Watts	1.861 Watts

* Measurements are made after loading GDRV and GFIND, with no connection to terminal panel.

Specifications of the WB-DynaRes 8 and WB-DynaRes 16:

ACCURACY *WB-DYNARES 8/16 GENERAL CONDITIONS ACCURACY –*

Range	Typical Resolution at Full Scale	Absolute Accuracy, the Larger of	
		% of Range:	% of Reading:
-5 to +50 mV	12 µV	0.08%	–
-25 to +25mV	12 µV	0.16%	–
-50 to +500mV	120 µV	0.05%	0.2%
-250 to +250 mV	120 µV	0.05%	0.2%
-1 to +10 V	2.4 mV	0.05%	0.2%
-5 to +5 V	2.4 mV	0.05%	0.3%

(Range column labeled vertically: VOLTAGE)

General Conditions – From 15 to 35 degrees C. ambient at the interface board, source resistance less than 1k Ohms. Includes linearity, drift, offset, resolution, and calibration error. 12 bit (0.024%) resolution in use.

Thermocouple Conditions – Same as General Conditions. Does not include the accuracy of the thermocouple itself. Includes cold junction compensation with T71-TC terminal panel only. Resolution assumes 12 bit resolution in use; it is approximate because resolution varies with temperature. (Please see your terminal panel manual's specifications for cold junction compensation error.)

Thermocouples use the 50 mV range. For inputs below -5 mV (below approximately -100 degrees C.) use the +/-25 mV range. For the best resolution use the 50 mV range above -5 mV.

WB-DYNARES 8/16 THERMOCOUPLE ACCURACY –

Type	Range (°C.)	Resolution (°C.)	Accuracy (°C.)
J	-210 to -100	0.1 – 0.3	± 2.3
	-100 to 0	0.05	± 1.2
	0 to 880	0.05 – 0.2	± 1
K	-250 to -75	0.15 – 1.0	± 8
	-75 to -1260	0.07 – 0.3	± 1.4
	0 to 900	0.06 – 0.2	± 1.2
E	-250 to -70	0.1 – 0.5	± 4
	-70 to 100	0.04	± 1
	100 to 680	0.04 – 0.15	± 0.8
T	-250 to -50	0.15 – 0.8	± 6
	-50 to 10	0.06	± 1.4
	10 to 150	0.06	± 1.2
	150 to 400	0.06 – 0.1	± 1
S	-50 to 120	0.4	± 10
	120 to 380	0.3	± 5
	380 to 1770	0.2 – 0.6	± 4
R	-50 to 250	0.2 – 0.4	± 10
	250 to 800	0.2	± 4
	800 to 1770	0.2 – 0.4	± 3
B	200 to 300	0.7 – 1.0	± 20
	300 to 500	0.4 – 0.7	± 13
	500 to 1000	0.2 – 0.4	± 8
	1000 to 1820	0.2 – 0.4	± 4
G	25 to 200	0.2 – 1.0	± 15
	200 to 2315	0.15 – 0.8	± 4
D	-20 to 2315	0.2 – 1.0	± 4
	150 to 2000	0.15 – 0.6	± 3
C	-20 to 2315	0.15 – 1.0	± 4
	100 to 1500	0.15 – 0.4	± 3
N	-200 to -100	0.7 – 1.4	± 5
	-100 to 1300	0.4 – 0.7	± 3

WB-DYNARES 8/16 RTD ACCURACY –

Set Resistor Ω	RTD Ω	Range °C.	Resolution °C.	Accuracy °C.
10 k	50	-200 to 115	0.02 to 0.1	0.9
20 k	50	-200 to 525	0.04 to 0.2	1.2
20 k	100	-200 to 115	0.02 to 0.1	0.9
50 k	50	-200 to >850	0.1 to 0.5	2.1
50 k	100	-200 to 750	0.05 to 0.2	1.4
50 k	200	-200 to 115	0.02 to 0.1	1.0
100 k	100	-200 to >850	0.1 to 0.5	2.1
100 k	200	-200 to 750	0.05 to 0.2	1.4
100 k	500	-200 to 115	0.02 to 0.1	0.9
200 k	200	-200 to >850	0.1 to 0.5	2.1
200 k	500	-200 to 525	0.04 to 0.2	1.2
200 k	1000	-200 to 115	0.02 to 0.1	0.9
500 k	500	-200 to >850	0.1 to 0.5	2.1
500 k	1000	-200 to 750	0.05 to 0.2	1.4
1000 k	1000	-200 to >850	0.1 to 0.5	2.1

RTD Conditions – Same as General Conditions. Does not include the accuracy of the RTD sensor itself. Includes linearization and signal conditioning errors. Resolution assumes 12 bit resolution is in use. RTD measurements are on the 50 mV range.

STABILITY Accuracy specifications in this chapter already reflect these temperature drift errors for temperatures from 20° through 40° C.:

WB-DYNARES 8/16 STABILITY –

Range	% of °C.	% Over a Year
50 mV	± 0.001	± 0.02
± 25mV	± 0.001	± 0.02
all other voltage ranges	± 0.0025	± 0.03

In many applications, stability and noise can be more important than absolute accuracy. This is "repeatability." Calculate the repeatability of a reading by adding together the stability and noise for the range you want.

INPUT IMPEDANCE The WB-DynaRes 8/16 has an input impedance of > 20 M Ω.

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CMRR – The Common Mode Rejection Ratio (CMRR) is >20 dB. Conditions for CMRR: DC to 400 Hz, common mode input +/- 7.0 Volts channel to ground. This specification applies even when one or more nonmeasured channels exceeds the operating common mode range.

WB-DYNARES 8/16 NOISE REJECTION –

Range	Typical Internal Noise (RMS)
50 mV	1 µV
± 25 mV	1 µV
500 mV	5 µV
± 250 mV	5 µV
10 V	100 µV
± 5 V	100 µV

COMMON MODE   ***Operating, channel-to-ground –*** ±7 Volts
RANGE

Nonoperating – 50 Volts continuous, 150 Volts for one second, nonrepetitive.

INPUT PROTECTION   50 Volts continuous.150 Volts for one second, nonrepetitive.

RESOLUTION/   Selectable in software:
SCAN RATE

WB-DYNARES 8/16 RESOLUTION AND SCAN RATE* –

Resolution at Full Scale	Scan Rate
low noise mode: 0.0004%	45/55 Hz
12 bits: 0.024%	1,200 Hz
11 bits: 0.05 %	1,400 Hz
10 bits: 0.1 %	1,700 Hz

* Rates describe an IBM PC 486DX2 66MHz running WorkBench PC for Windows under Windows 3.1 with Tolerate Error=0. Rates are somewhat faster in faster computers. Please also see "Dynamic Resolution" on page 1 – 2.

Scan Rate – Scan rate is the rate in Hertz (or, samples per second) to read data into memory, including the time it takes to switch channels and ranges. To calculate the total scan time for all channels, divide the rate by the number of channels.

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COUNTER/TIMER The WB-DynaRes 8/16 has one on-board 16 bit counter/timer with 2 MHz internal clock.

GENERAL CONDITIONS *Maximum Voltage on any terminal –* 150V

Maximum Current on any terminal – 1A

Auxiliary Power Supplies – +5V, +12V, or -12V, direct from the computer's power supply. The +6.9V supply draws it's current from the +12V supply.

Voltage	Maximum Current
+6.9V	20mA
+12V	200mA
+5V	100mA
-12V	200mA

+6.9V Supply Tolerance – ± 5%

· *Temperature Coefficient: < 0.0005% per ºC*

· *Stability: < 0.01 per year*

Operating Temperature Ambient – 0 to 50 degrees Celsius.

Physical Dimensions– 6.7" x 4.0" (17.0cm x 10.2cm)

WB-DynaRes 8/16 Current Consumption* –

Voltage	Supply Current Consumed by	
	WB-DynaRes 8:	WB-DynaRes 16:
+5V	317mA	335mA
+12V	10.5mA	13mA
-12V	1.6mA	2.5mA
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* Measurements are made after loading GDRV and GFIND, with no connection to terminal panel.

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