CS100

Kiln Shell Temperature Monitoring System

Manual

Raytek®
A Fluke Company

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TABLE OF CONTENTS

1. Technical Data

1.1 Specifications

Linescanner

Type	DEDTMP50HR (or DEDTMP40HR)
Temperature range:	100 to 650°C (212 to 1202°F)
Optical resolution (90% energy)	100 : 1 (IFOV = 10 mrad)
Spot detection (50% energy)	300 : 1 (IFOV = 3 mrad)
Spectral response:	3.5 to 4 µm
Optical scan rate:	max. 36 Hz (DEDTMP50HR)
Scan angle (FOV):	90°
Accuracy:	± 2 % of reading or ± 2°C (± 4°F), whichever is greater at -40 to 45°C (-40 to 113°F) ambient temperature
Repeatability:	± 1 % of reading or ± 1°C (± 2°F) of mid-range, whichever is greater at -40 to 45°C (-40 to 113°F) ambient temperature
Detector:	HgCdTe
Sampling rate:	Analog peak picker function for 1024 pixel equivalent sampling rate, processed into 256 transmitted separate measuring points
Standard focal distance:	infinity
Mechanical scanning system:	MTBF: 40,000 hours
Power requirement:	85 to 264 VAC (for interface box)
Environmental rating:	IP65 (NEMA4) protection for linescanner
Ambient temperature range: (for scanner with enclosure)	
- without cooling:	-40°C to 45°C (-40 to 113°F), no direct sunlight
- with water cooling:	max. 125°C (257°F)
Minimum installing temperature:	-10°C (14°F)
Water cooling:	max. pressure 5 bar (72.5 psig)
Warm-up time:	20 minutes

System

Max. kiln speed:	4 rpm / 100 scan lines 5 rpm / 72 scan lines
Min. kiln speed:	default: 0.5 rpm (for synchronized measurement) minimum: 0.05 rpm (changeable with CS100conf.exe)
Simulated kiln speed:	1 rpm (for kiln speed < 0.5 rpm)
Packaging:	RAYTCS101: 3 cases, 30 kg (70 lbs) RAYTCS102: 5 cases, 55 kg (125 lbs)

1.2 Package

The CS100 package includes:

Linescanner package: (2 units for CS102)	CS100 linescanner DEDTMP50HR Operators Manual and Protocol Manual 7.5 m (24.6 ft) RS485 high temperature cable 7.5 m (24.6 ft) high temperature power cable 7.5 m (24.6 ft) high temperature trigger cable RS485/RS232 converter SUB-D connector cable, 25-pin (male) to 9-pin (female) Spare window
Protective Enclosure: (2 units for CS102)	Stainless steel box with exchangeable window Quick release mounting system Adjustable mounting bracket Spare window assembly Tool for opening doors
Interface:	Interface box with customer cable connector set, 2x RS232 SUB-D connector cable, 25-pin (male) to 25-pin (female), line cord Linescanner Connection box (two boxes for CS102)
Position indicator:	High temperature sensor head with separate electronics and connection box
Software:	DataTemp CS100
Tools:	Hex key wrench 2.5 mm Hex key wrench 4 mm Hex key wrench 5 mm Wrench 7x8 and 10x13 1x connector (female) 4-pin for analog Outputs
Documentation:	User manual CS100, Linescanner Manual MP50, Interface Protocol Description Linescanner MP50 on CD-ROM

1.3 Weights and Dimensions

Linescanner package:	Length:	180 mm (7.09 inches)
	Width:	120 mm (4.72 inches)
	Height:	200 mm (7.87 inches)
	Weight:	7 kg (15.4 lbs)
Protection Housing:	Length:	300 mm (11.81 inches)
	Width:	300 mm (11.81 inches)
	Height:	300 mm (11.81 inches)
	Weight:	8 kg (17.6 lbs)

Protective Enclosure:	Length:	452 mm (17.79 inches)
(with mounting bracket	Width:	496 mm (19.53 inches
and protective sighting channel)	Height:	450 mm (17.72 inches)
	Weight:	13 kg (28.6 lbs)
Linescanner Connection box:	Length:	225 mm (8.86 inches)
	Width:	125 mm (4.92 inches)
	Height:	90 mm (3.54 inches)
	Weight:	2 kg (4.2 lbs)
Position indicator:		
Sensor head:	Length:	50 mm (1.97 inches)
	Diameter:	50 mm (M50 x 1,5) (1.97 inches)
	Weight:	0.3 kg (0.66 lbs)
Connection box:	Length:	84 mm (3.31 inches)
	Length:	110 mm (4.33 inches) with electronic tube
	Width:	79 mm (3.11 inches)
	Height:	67 mm (2.64 inches)
	Weight:	0.7 kg (1.5 lbs)
Interface without connectors:	Length:	256 mm (10.08 inches)
	Width:	257 mm (10.12 inches)
	Height:	115 mm (4.53 inches)
	Weight:	3 kg (7.5 lbs)

1.4 PC System Requirements

Hardware:

- 200 MHz or better Pentium Pro ™ /Pentium II ™ class system with 64 MB RAM (400 MHz or better for a 2 scanner system CS102)
- 800 x 600 graphics capability (High Color 16 Bit)
- 4 GB hard disk, CD-ROM
- PS/2 mouse, for each scanner a separate RS232 ports (FIFO)
- Standard baud rate: 57.6 kBaud

Software:

- MS Windows NT 4.0 (with service pack #5) or MS Windows 2000 / XP
- MS Access 97 / 2000 / XP

2. Components

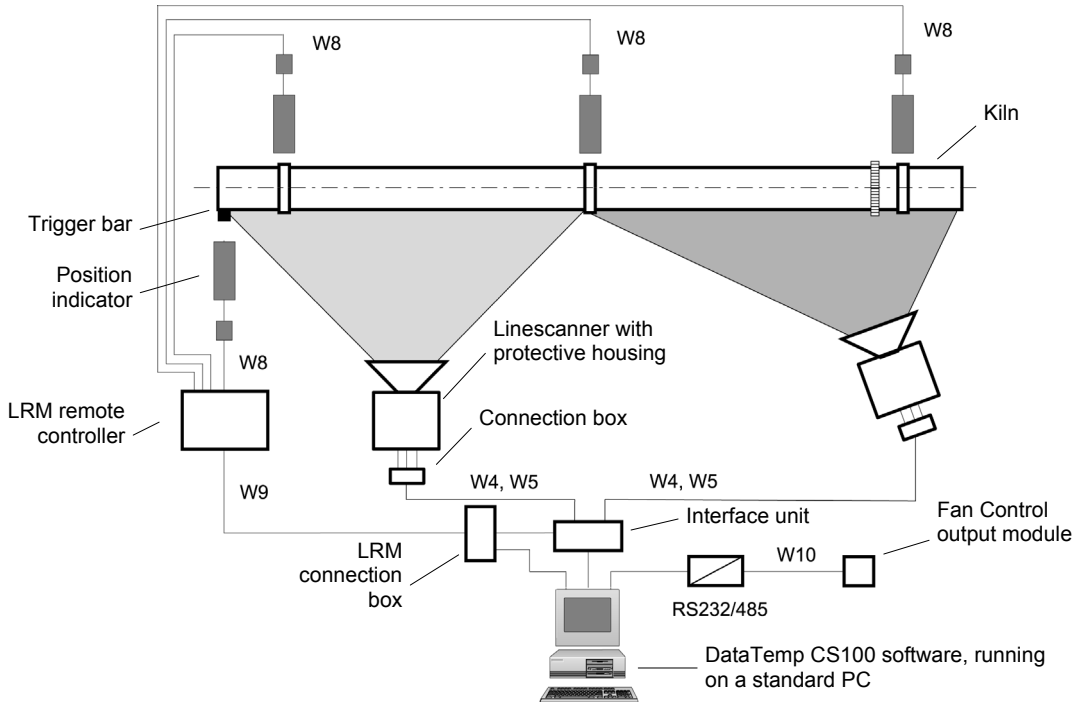


Figure 1: CS100 system overview with LRM (option) and Fan Control (option)

2.1 Linescanner

The CS100 system consists of a linescanner (CS102 system: two linescanners). The linescanner collects infrared energy, emitted from the kilns surface within a 90° field-of-view along the axis of the kiln, see the figure above. This allows the system to determine the temperature along the length of the kiln.

2.2 Protective Housing

To eliminate the influence of the common operating temperature and the atmospheric quality near the kiln, the scanner is protected by a rugged stainless steel protective housing. Air purging and/or water cooling is available, if required (CS102 system - contains two protective housings).

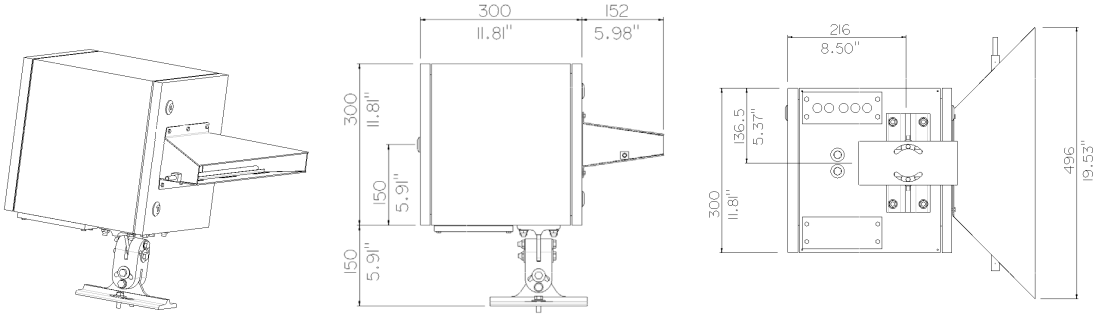


Figure 2: Protective Housing

2.3 Connection Box

The linescanner connection box can be mounted up to 7 meters (23 ft) away from the scanner, but for aiming reasons, it is the best that the connection box is mounted as close to the scanner as possible. The cable between the sensor head and the connection box needs to be protected from mechanic damage. For the dimensions of the scanner connection box (CS102 system - contains two boxes).

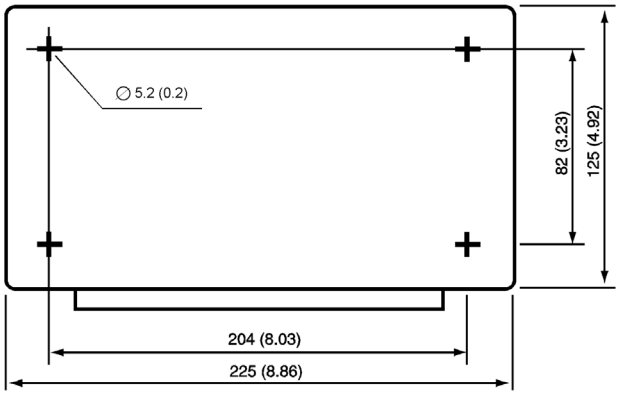


Figure 3: Connection box

2.4 Interface Box

The interface box includes the data transmission, kiln synchronization, alarm and scanner power supply modules. It needs to be located close to the personal computer, see the following figure:

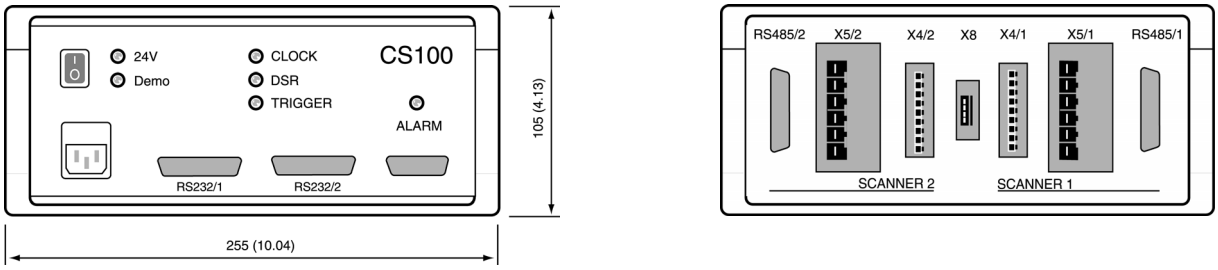


Figure 4: Interface Box (left: front side, right: back side)

2.5 Position Indicator

The position indicator is a temperature resistant inductive sensor used to synchronize the scanning system according to the kiln's rotation. The maximum ambient temperature for the position indicator is 230°C (446°F). For the electronic housing a maximum ambient temperature of 70°C (158°F) is allowed. The output of the position indicator is low-active.

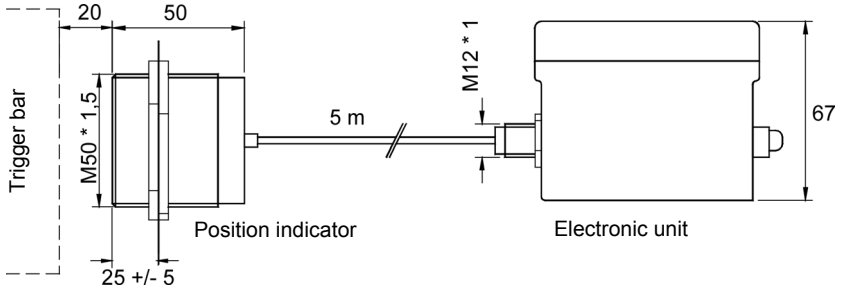


Figure 5: Position Indicator

2.6 Cables

The following cables are necessary according to the standard installation, see also system drawing given in appendix 8.8 to 8.10.

- **W4** from the connection box (next the linescanner) to the interface box in (operator room). This four-wire-cable is used for the power supply of the linescanner. The cable cross-section depends on the distance between the interface and the linescanner (see table below).
- **W5** from the connection box (next the linescanner) to the interface box in (operator room). This cable is for the bi-directional data transfer between linescanner and interface.
- **W8** from the position indicator to the interface box (operator room). This cable connects the position indicator and the interface.
- **W9** from the LRM remote controller to the LRM connection box.
- **W10** from the RS232/485 converter to the fan control output module.

Attention: All cables are shielded. The wires from W5 and W9 must be a twisted pair. Local building codes may need to be considered when selecting cables.

Cable	Distance	Cable features	Example	Supplied from …
W4	< 200 m (< 220 yards)	4 × 1.5 mm², 16 AWG, 4 conductor, shielded	(N) YMHCY-J 4 × 1.5 Manhattan/CDT, P/N M4724	Customer
	200 m to 350 m (220 to 380 yards)	4 × 2.5 mm², 14 AWG, 4 conductor, shielded	(N) YMHCY-J 4 × 2.5 Manhattan/CDT, P/N M33848	Customer
W5	350 m (380 yards)	4 × 2 × 0.25 mm², 24 AWG, 4 pair, shielded	LifYCY 4 × 2 × 0.25 mm² Manhattan/CDT, P/N M13193	Customer
W8	350 m (380 yards)	3 × 0.25 mm², 24 AWG, 3 conductor, shielded	(N)YLHCY-J 3 × 0.25 mm² Manhattan/CDT, P/N M13233	Customer
W9	350 m (380 yards)	3 × 2 × 0.25 mm², 24 AWG, 3 pair, shielded	LifYCY 3 × 2 × 0.25 mm²	Customer
W6, W7		Standard RS232 cable		Raytek
W10	500 m (540 yards)	2 × 2 × 0.25 mm², 24 AWG, 2 pair, shielded		Customer

3. Installation

The customer is responsible for preparation of the sensor stand, the position indicator place with the trigger bar and the complete wiring of the cables according to the following description.

3.1 Sensor Mounting Stand

3.1.1 Distance to Kiln

The linescanner needs free optical sighting for a 90° field-of-view along the kiln's length. The scanning angle of the scanner is 90°. Calculate the relationship between the scan line width and the distance to kiln:

$$D \geq \frac{1}{2} L$$

where:

D … Distance between scanner and kiln

L … kiln length (requested scan width)

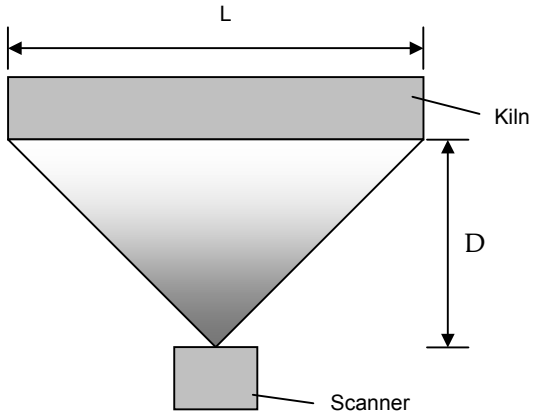


Figure 6: Distance between Scanner and Kiln

3.1.2 Alignment of Scanner

The scanner should point to the centre of the kiln.

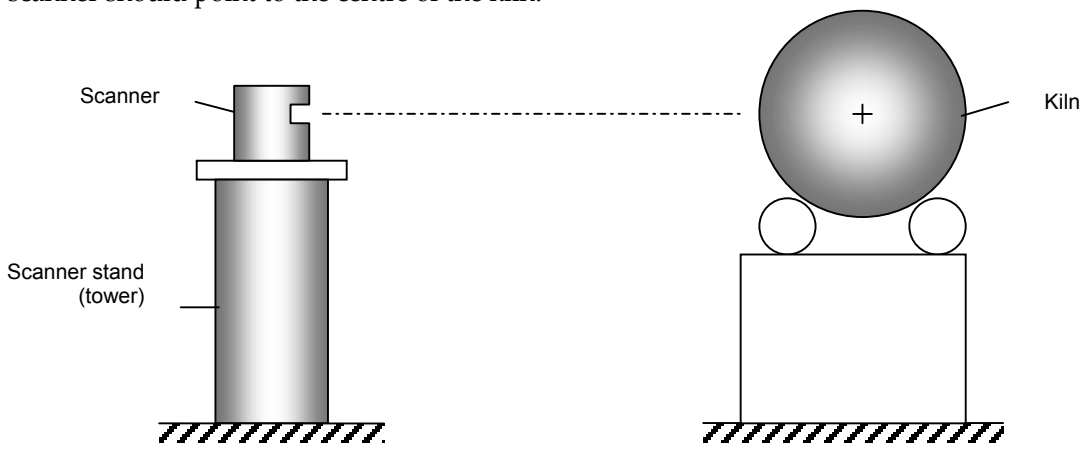


Figure 7: Alignment of Scanner

3.2 Mounting

The protective housing, which contains the linescanner, will need a solid vibration-free mounting stand. The protective housing comes with a 3-axis-mounting bracket, in all 3 axis 90° adjustable. To mount the protective housing onto the sensor stand, e.g., on a tower, it only needs a joint plate, with two 8.5 mm (0.31 in.) diameter mounting holes, see following figure.

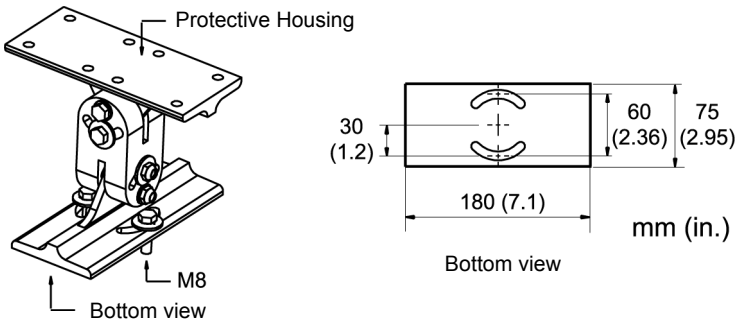


Figure 8: Protective housing's 3-axis mounting bracket

Warning:

- The maximum ambient shadow temperature for the scanner within the protective housing is 45°C (113°F). If necessary, add an additional shaded roof to protect the protective housing from direct sunlight or use the cooling box option, for further information see appendix 8.2 Protective Housing on page 63.
- For grounding the sensor stand, please refer to the local building codes for lightning protection.
- The housing of the linescanner and the connection box need the same potential. (Check for good electrical contact at grounding wire connection).

Preparing the protective housing to be mounted on the sensor stand

Open the protective housing from the back to access to the parts inside. On the bottom of the box, there is a rail/carrier system for assembling the linescanner. Open the latches on both sides of the rail, loosen the bolt on top of the carrier and take off the carrier. Mount the linescanner onto the carrier using the 4 M6 x 12 screws. Connect the earth ground to the top of the linescanner. To install the ground on the left mounting thread, use a M6 x 12 hex hd screw with washer and lock washer.

Mounting the protective channel and the window

Open the front door of the protective housing. Mount the protective field-of-view channel on the front side by using 6 M4 x 12 bolts. The slotted side of the protection channel should be on the bottom. The bolts must be inserted from inside the box (the nuts are outside).

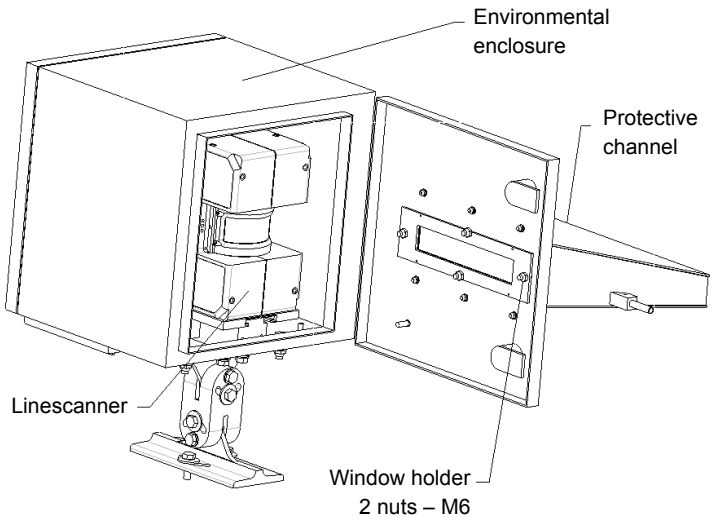


Figure 9: Protective housing with protective channel

Installing the linescanner
Open the back door. Insert the linescanner (with the mounted carrier) into the rail/carrier system. Lock in the linescanner with the latches and screw.

Electrical Installation
For best performance, the electrical installation of the CS100 System should correspond to one of three recommended installation configurations illustrated in appendix 8.8 to 8.11. The most common system configuration is represented by figure according to appendix 8.8 One Scanner Standard Installation on page 68 and employ copper wiring/cabling throughout.

System Installation - all copper wiring/cabling
Install wire/cable in accordance with recommended system configurations as depicted in appendix 8.8 to 8.10. Cable specifications are provided above in section 2.6 Cables on page 6.

System Installation - fiber-optic cable (optional)
Install cable in accordance with recommended system configurations as depicted in appendix 8.11 followed by a detailed description.

Connecting the cables
Install the cables W1, W2, and W3. These cables are located between the linescanner and the connection box). Open one grommet plate (on the bottom of the protective housing) by loosening the three allen-bolts. Use a grommet for each cable. For the W1 cable, use a grommet with inside diameter of 5 mm (0.2 in.), for the W2 and W3 cable, use grommets with inside diameter of 7 mm (0.28 in.). The grommets need to be situated 400 mm (15.8 in.) away from the linescanner connectors (round plugs). Place the grommet plate over the grommets as shown in figure below. Be careful to have the cable identification plates pointed toward the side of the connection box (longer end of the cables). Close unused holes with the blind grommets. Close the grommet plate.

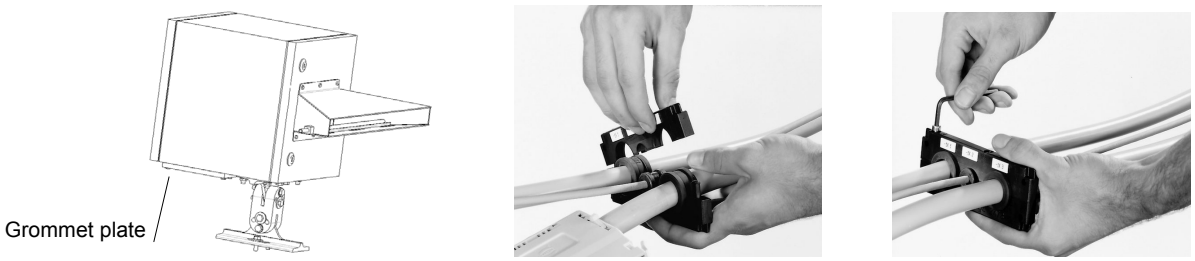


Figure 10: Cable installation

Using the 4 M5x25 screws, mount the grommet plate on the outside of the protective housing. Plug the cable connectors into the linescanner. Connect the socket and the plug for earth ground.

Note: If installing the CS100 system in a warm environment, water cooling may be necessary. The tubes used for water may be run through the grommet plate.

3.3 Connection Box

Mount the connection box. Insert the cables W1 to W5 using the grommet plate according to the cable diameter. Choose the correct grommets. Install the cables as shown in Figure 10. The grommet plate should be directed to the bottom.

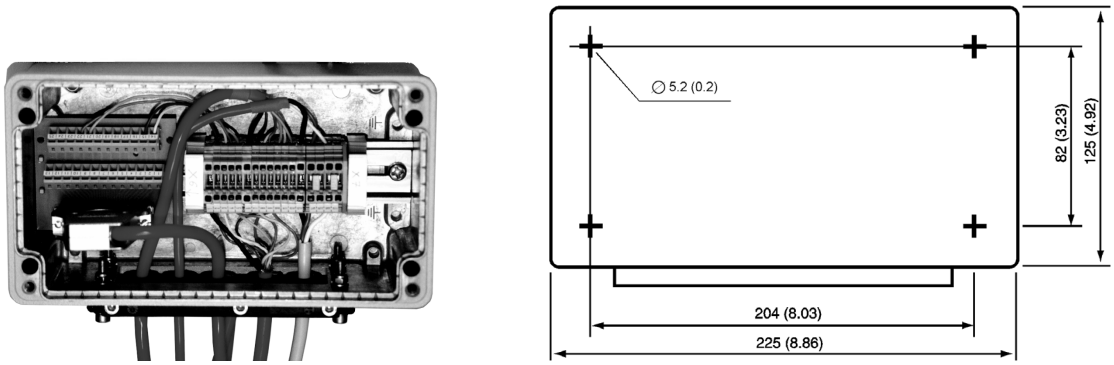


Figure 11: Connection box

3.4 Position Indicator

The position indicator is an inductive proximity switch. It consists of two parts, a high temperature sensor head, and an electronic housing. Since its maximum ambient temperature is 230°C (446°F), the sensor may be mounted near the kiln's surface.

Both components, sensor and electronics housing, are connected via a high temperature cable (length: 5 m / 15 ft). Protecting the cable against mechanical stress is recommended. The position indicator is necessary to generate a trigger pulse for the CS100 system. Therefore, a trigger bar must be welded on the "colder" end of the kiln, see appendix and photo example on the CD-ROM.

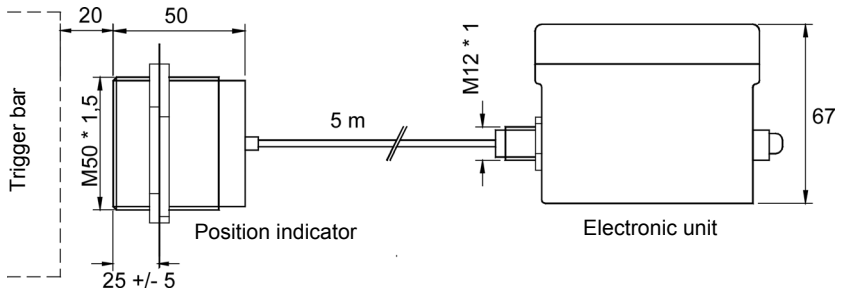


Figure 12: Position Indicator and Electronic Unit

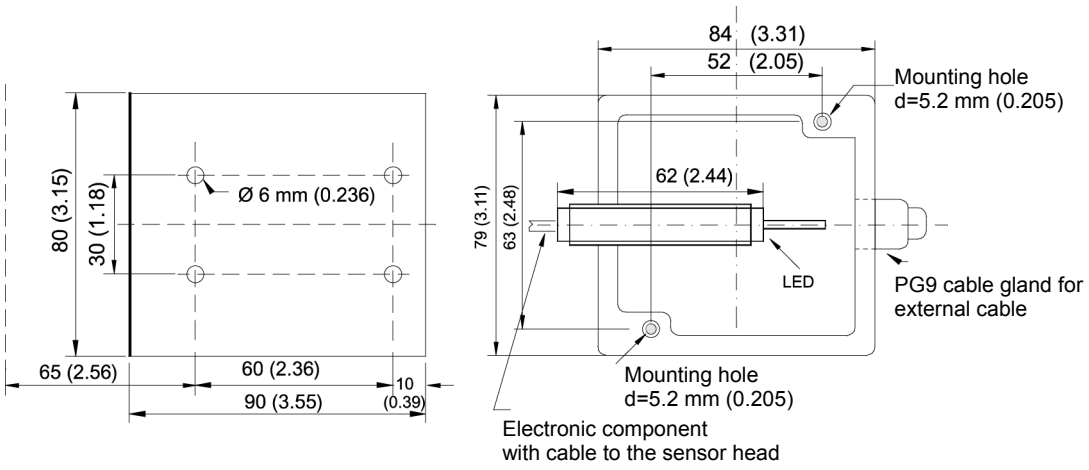


Figure 13: Dimensions of Electronic Unit

The distance between trigger bar and position indicator is very important for the function of the system. If the distance is to small, the trigger bar can destroy the sensor head. On the other hand, if the distance is too big, the position indicator will be unable to register the trigger bar. Thus, it will not be able to generate the trigger pulse for the system.

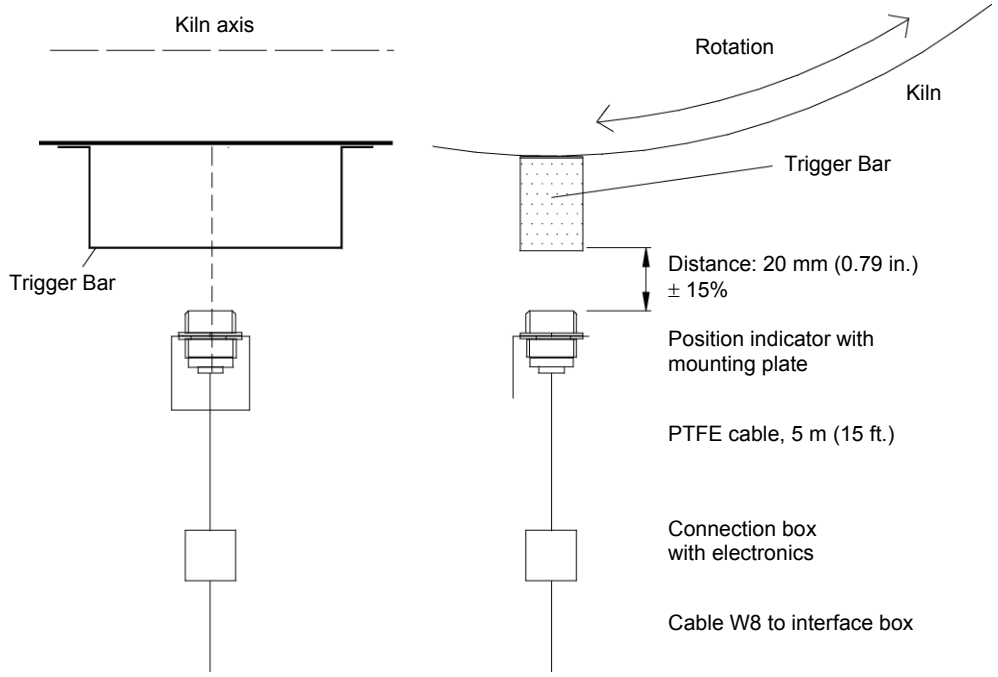


Figure 14: Mounting the Position Indicator

Adjustment of the position indicator:

1. Mount the trigger bar.
2. Mount the mounting plate of the position indicator.
3. Check the distance between position indicator and trigger bar.
   Attention: If the trigger bar hits the position indicator, the indicator will be damaged.
4. Fix the position indicator and control the function. With every revolution of the kiln you should obtain a trigger pulse exciting a lighting of the LED in the connection box with electronics or on the front side of the interface box.

3.5 Interface Box

The interface box comes with an accessory box. All required connectors are included in this box. The connections are marked on the housing of the interface box. The 15-pin D-connector is the alarm relay connector for the scanner alarm output. The internal relay connects pin 1 and 2 in case of no alarm, pin 2 and 3 in case of alarm. Contact: max. 30 V/ 1 A. In two scanner systems both scanner alarm outputs are wired in parallel.

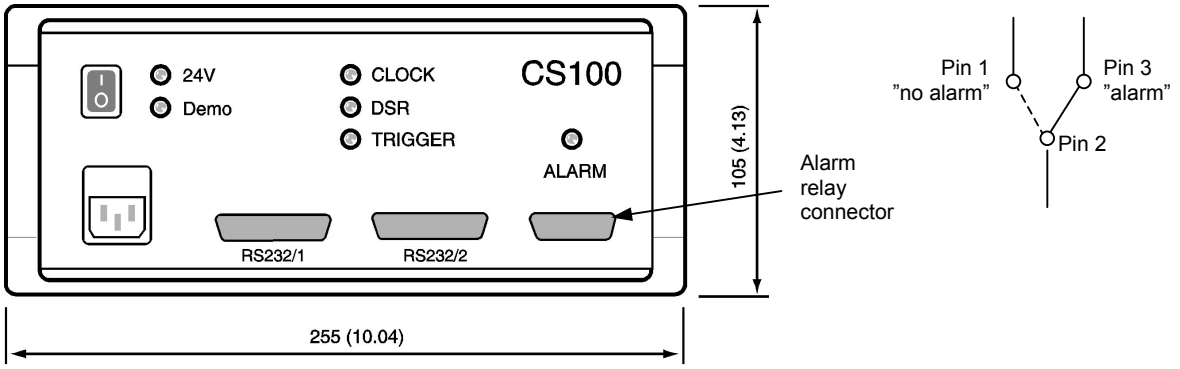


Figure 15: Front view of Interface Box (left), Pins of Alarm Relay Connector (right)

Connect the cables W4, W5 and W8 with the connectors on the backside of the interface box. Connect the interface connector RS232/1 with the first COM port from the computer. If two scanners are installed, you need to connect the interface connector RS232/2 with the second COM port. After double-checking all connections, switch the interface box to ON. The 24V-LED indicates the ON/OFF status. Check the trigger function. After the first two rotations, which are necessary for internal synchronization, the three LED's TRIGGER, CLOCK, and DSR show the trigger status. The following figure shows the status diagram for a properly running system in the synchronized mode:

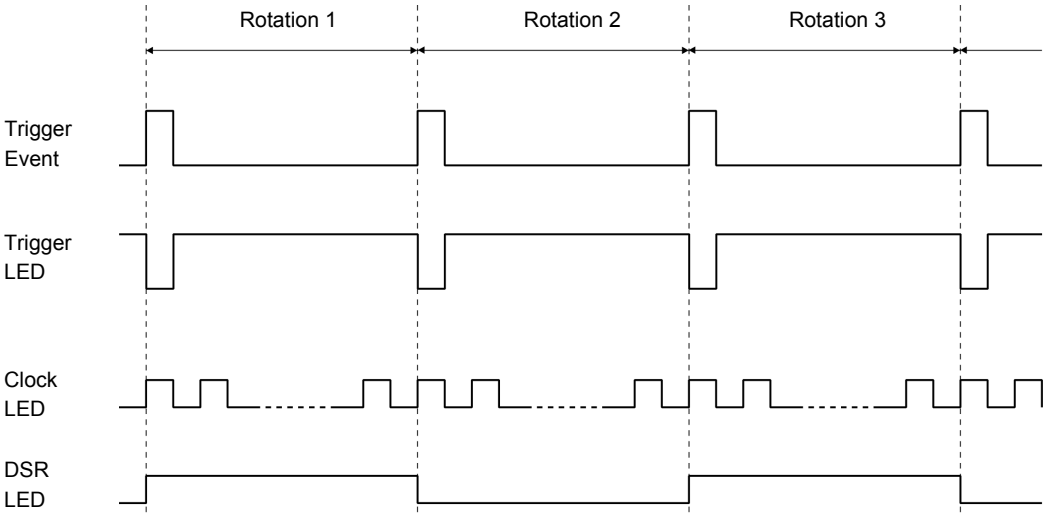


Figure 16: Status Diagram for Synchronized Mode

Note: In case of a non-existing or incorrect (too small time gap between two trigger pulses, see requirements for minimum kiln speed in section 1.1 Specifications on page 1) trigger signal,

the system switches to the non-synchronized mode. This mode is detectable by the simultaneous blinking of the DEMO-LED and the CLOCK-LED. To ensure the display of a non-synchronized thermogram in the running software, the option <See incomplete lab in realtime screen> must be activated, see section 4.2.2 <Scanners> Register on page 17. Non-synchronized thermograms are not stored in the database.

3.6 Start-up-Service Option

The start-up service includes the installation of the scanners into the protective housing boxes, **checking** all wiring, communications and services from the scanners to the location of the computer. The scanner alignment will be checked and corrected as necessary. Software will be installed, and all users will be trained on the full operation of the system, including routine maintenance procedures. The entire system will be operational before the final acceptance and sign-off by the customer. Raytek **does not** provide construction, erection, mechanical, electrical or building services. Prior to the start-up service the enclosure housings should be installed in the designated locations per our recommendations. All wiring should be in place and the associated electronics positioned in the control room. Raytek will check the final connections and power the system. The scanner heads should not be put into the protective housings until this start-up service begins.

Note: The start up service option is not included in the CS100 standard package, it has to be ordered extra.

3.7 System Design Changes

WARNING!

Every change of the standard system design must be acknowledged from Raytek, otherwise the warranty of the complete system will be lost.

To avoid any grounding and earthing problems by using a local power supply for the scanner, it is recommended to power the scanner from the interface box.

4. Configuration

The following sections of this manual describe the operations required to work with the CS100 system. Complete configuration requires the following:

1. Software installation
2. Software configuration (number and position of the linescanners, definition of alarm zones, setting of the database, et cetera.)
3. User configuration (adding or modifying of the user's rights)
4. Setting of hardware alarm outputs (if required)
5. Setting a fail safe hot spot alarm (if required)
6. Adaptation of the emissivity value (if necessary)
7. Language configuration (adding or modifying of languages)

For the following sections, it is assumed the physical installation (communications and power wiring, air, water if necessary, et cetera) be completed and working.

4.1 Software Installation

4.1.1 Windows NT setting

ATTENTION!
Set the switch for "Select the performance boost for the foreground application" to NONE!
(Menu: Start / Settings / Control Panel / System / Performance / Application Performance)

4.1.2 Installation of the CS100 Software

Insert the DataTemp CS100 software CD into the CD-ROM drive. Click on the START button, then select RUN. Type D:\SETUP (assuming, D is your CD-ROM drive), and click <OK>. Follow the installation wizard´s instructions on the screen. The installation program creates a program group called DataTemp CS100.

Attention: After installation of DataTemp CS100 the program READSCAN (to be found in the CS100 program group) has to opened and to closed one time for a successful Windows registry.

4.2 Software Configuration

To configure the DataTemp CS100 software select the start menu, activate the CS100 program group and click on the icon <Configuration>. Afterwards a window for inquiring of the password appears. Once the user has been correctly identified (default setting: user: **a** , password: **a**), the following window appears:

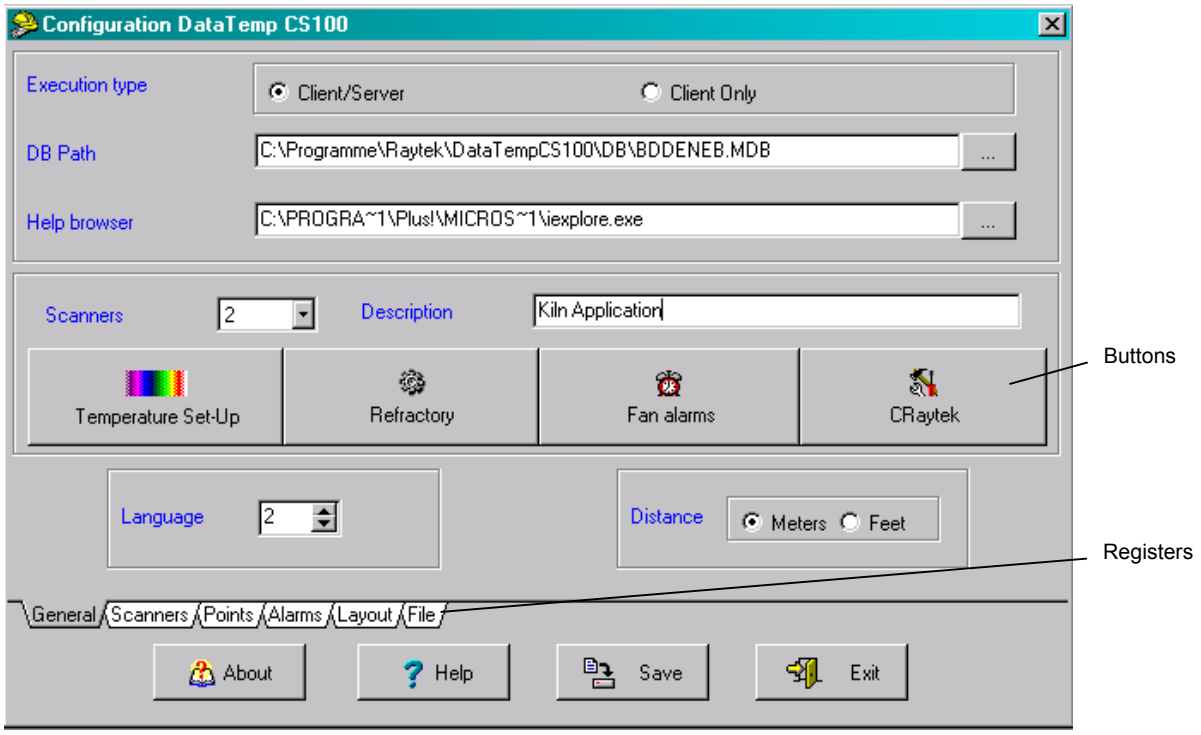


Figure 17: The General Register

This dialog box contains registers and buttons. In the following sections first all registers are explained. Afterwards the available buttons are described.

Note: Every changes in the software configuration must be saved before the parameters are valid!

4.2.1 <General> Register

With the <General> register, see figure above, the execution type for the CS100 application is set.

The **<Client/Server>** type allows the execution of the CS100 program and the corresponding database on the current PC simultaneously.

With the **<Client Only>** type, it is possible to access to the database with the current PC via a network. The CS100 program is not executed. When selecting this option the database path must be given, whereby the database requires full access rights from the operating system. The simultaneous access to the database with several PC's is possible.

With the **<Help Browser>** it is necessary to give the path to the internet explorer. The explorer shows the integrated CS100 help files; e.g. C:\Programme\Internet Explorer\Iexplore.exe

With the other options in the <General> register some general settings are initialized: the number of the scanners, the description, the units and the language. To add or modify a language see section 4.7 Language Configuration on page 31.

Attention: It is strongly recommended to select the requested physical units (distance and temperature) before all other changes!

4.2.2 <Scanners> Register

With this dialog box, the relative position of the scanners to the kiln, the serial COM-ports and the length of the kiln are set.

In 2 scanner systems, the angle χ defines a possible vertical offset of scanner 2 in relation to the position of scanner 1. E.g. for a quarter circle offset, the angle χ must be set to 90°.

<See incomplete lap in realtime screen>	Displays temperature data also in case of a incomplete (non-synchronized) kiln revolution.
<Diameter type>	Labeling of the y-axis of the thermogram either in angles (degrees) or as perimeter (cm).
<Inverse scale>	Inverses the direction for labeling the x-axis.
<Offset>	Starts the labeling of the x-axis with the given offset.

Note: <Inverse scale> and <Offset> affect only the labeling of the x-axis on the screen! The actual optical parameters of the linescanner are not influenced!

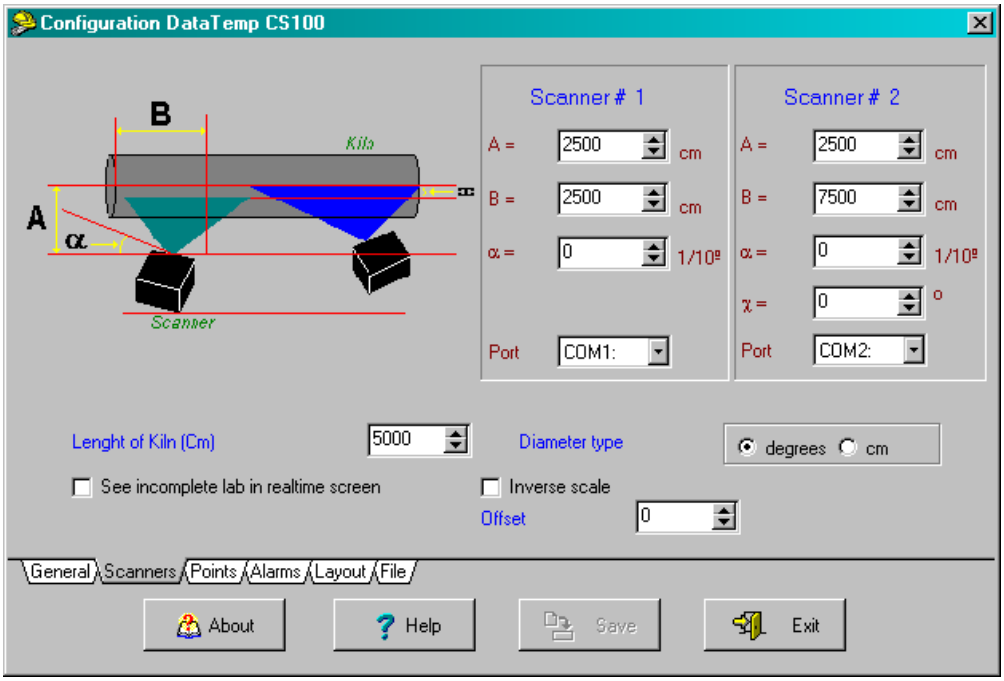
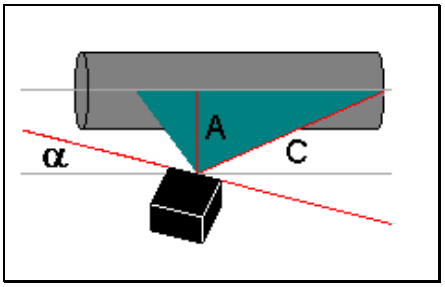


Figure 18: The Scanners Register



$$\alpha = \cos\frac{A}{C} - 45°$$

Figure 19: Calculation of α for a Non-perpendicular Scanner Mounting

Attention: The scanner must be aligned in that way, that the geometrical zero point for kiln (e.g. right edge) and the farthest right point of the scanners field of view (see the thermal image in the runtime software) are identically. Use a thermal marker on the kiln's surface (hot or cold spot) for identifying!

4.2.3 <Points> Register

This dialog box shows the location and horizontal resolution (as the difference between two consecutive points) of each point in the arrangement.

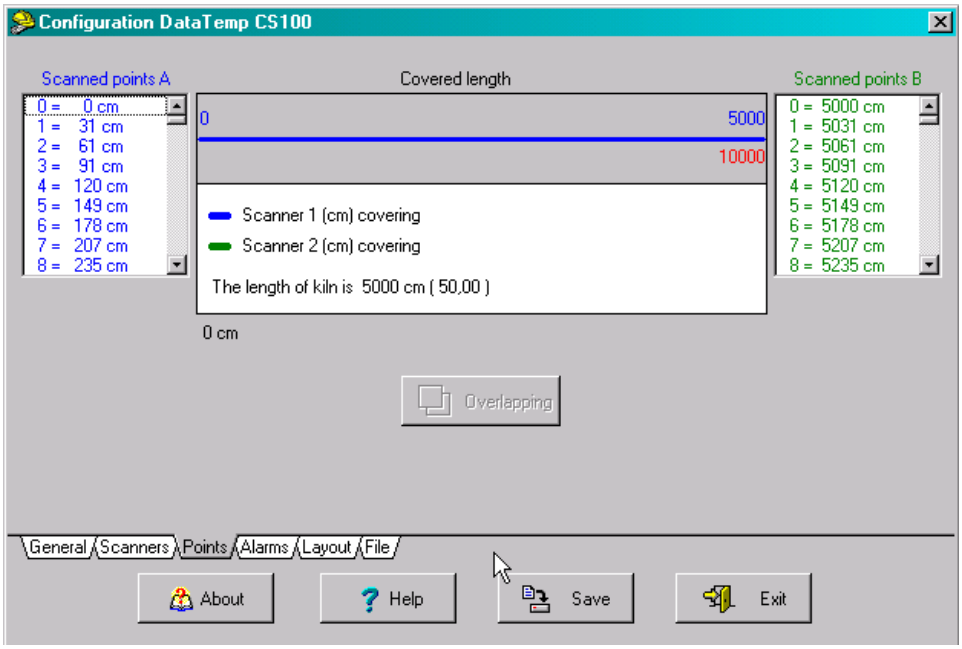


Figure 20: The Points Register

4.2.4 <Alarms> Register

This dialog box allows the configuration of up to 8 alarm zones. Each zone can be set with the zone width, the maximum temperature value and minimum temperature value.

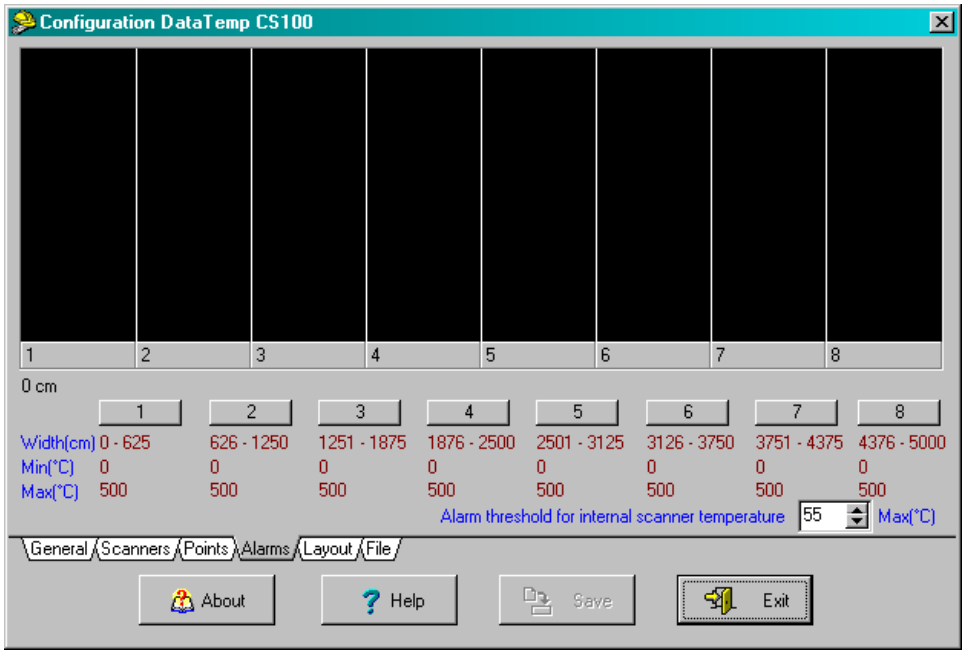


Figure 21: The Alarms Register

To ease the definition of each zone, a bitmap file (*.bmp) can be used. Double-click in the black window area and a file-open-dialog will appear to allow selection of a bitmap. It will be scaled to fit in the window. The position of each alarm zone can be set by dragging the borders in the bar below the bitmap with the mouse (the zone's horizontal coordinate is shown during this movement). To define the temperature range of a zone, click on the button with the number corresponding to the zone. The following dialog box will open containing the position (From cm / To cm) and the alarm barrier (Minimum / Maximum Temp) of the zone.

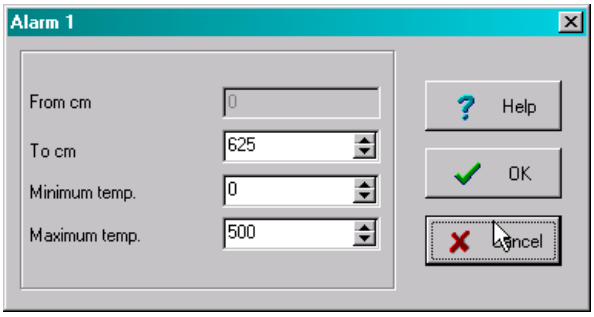


Figure 22: Setting an Alarm Zone

4.2.5 <Layout> Register

With this dialog box, the appearance of the profile graph and the thermogram are configured. This includes the X- and Y-scale, the presentation of the alarm zones and the color scale as on or off. With the <Font> button, the font used to display the characters is chosen. To see the layout, click the <OK> button.

The <Bars of frequency graph> option means the number of temperature steps in the histogram view.

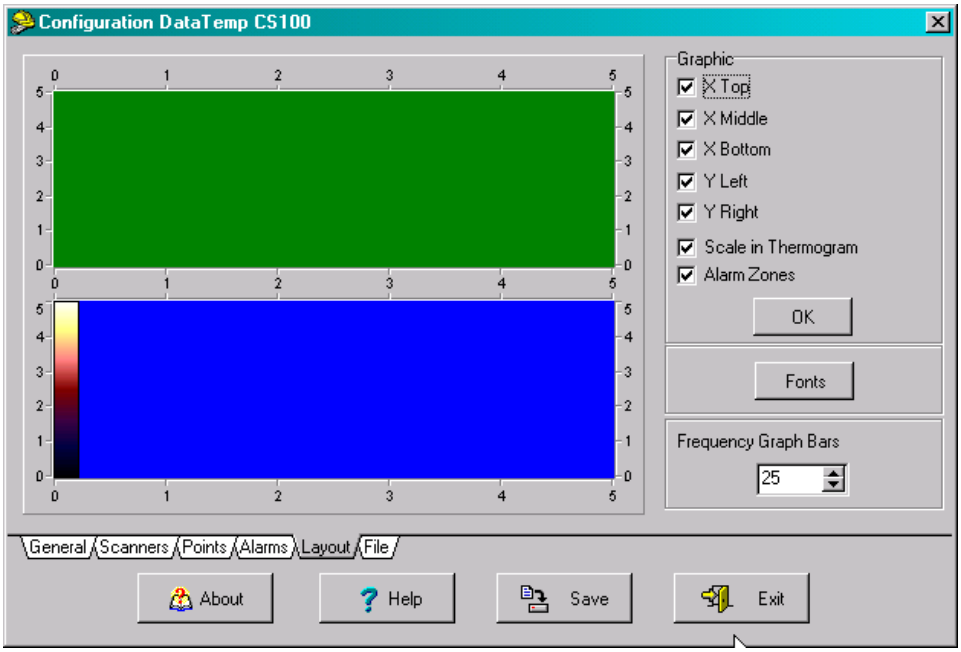


Figure 23: The Layout Register

4.2.6 <File> Register

With this dialog box, the intervals at which to store thermograms are defined. Two intervals are available, a short interval (short term, history) and a long interval (long term, day history).

In the shown example of the following screen shot, every 15 minutes a thermogram is stored in the short term. These thermograms may be called up in the main program by means of the menu item <File> <Open> <History>. In the given example the storage is limited for 30 days. If the number of saved days is reached it starts again from the beginning, overwriting the previous thermograms (ring buffer).

Every day at the time of 0^{10} h all thermograms of one day are averaged to only one thermogram in the long term. These thermograms may be called up in the main program by means of the menu item <File> <Open> <Day History>.

The necessary storage capacity of the hard disk is estimated with the following formula:

$$Q_{HD} \approx n \cdot 1440 \cdot \frac{Q_{Th} \cdot <SavingDaysShorTerm>}{<Interval>} + Q_{Th} \cdot <SavingPeriod>$$

Q_{HD}	necessary storage capacity of the hard disk in MByte
n	number of scanners
Q_{Th}	≈ 0.1 MByte, storage size for one thermogram
<SavingDaysShortTerm>	number of the days to store the thermograms in the short term
<Interval>	storage interval in the short term in minutes
<SavingPeriod>	considered saving period given in days

Using this formula for the example below a free storage capacity of the hard disk of at least 291 MByte is necessary (using one scanner).

$$Q_{HD} \approx 1440 \cdot \frac{0.1\text{MB} \cdot 30}{15} + 0.1\text{MB} \cdot 30 = \underline{\underline{291\text{MB}}}$$

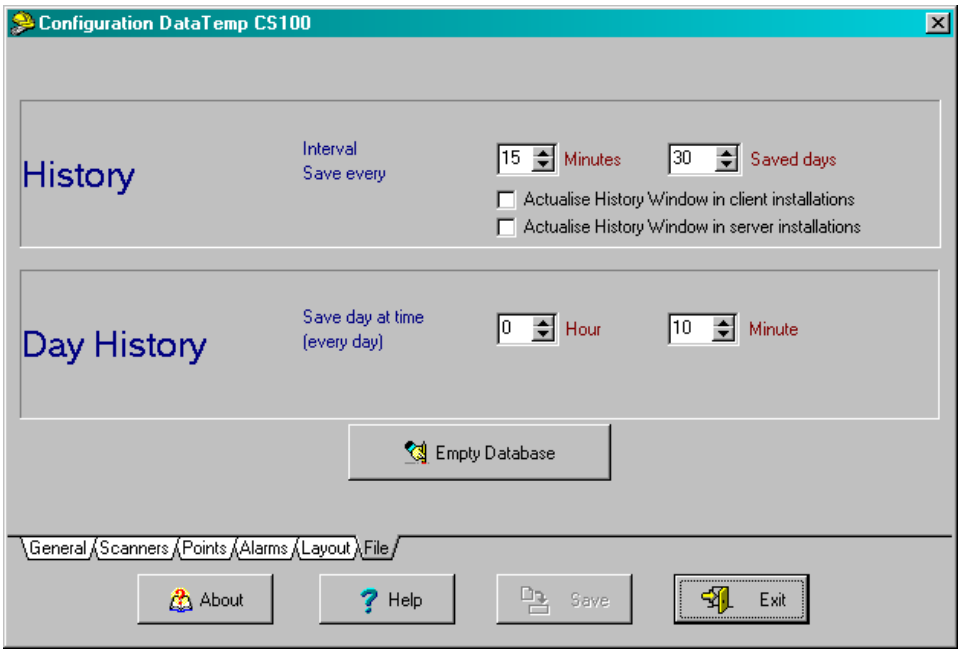


Figure 24: The File Register

Attention: Due to the Windows Operating System the data base size must be limited to 1 GByte (for Access 97) and 2 GByte (for Access XP). To avoid a lost of data restart with an empty data base like described below or change the saving interval!

With the <**Empty Database**> button, a new database may be created. The clicking on the <Verify operation> ensures that the current database is not opened by another user. After the successful verification it may be restarted with an empty database with the unchangeable default name BDDENEB.MDB. To avoid an overwriting, the still existing database with the same name is to be renamed or to be moved to another directory. The dialog box suggests the name BDDENEBOLD.MDB.

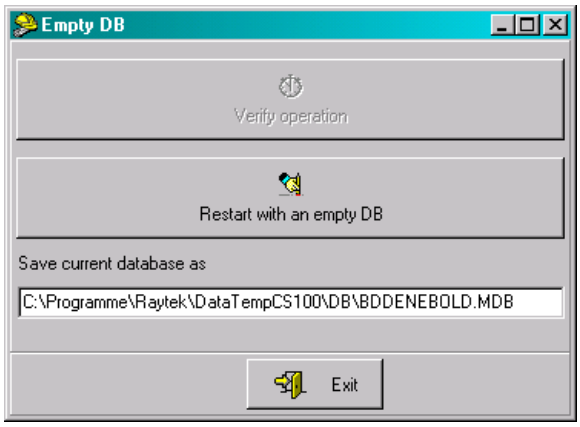


Figure 25: Restarting with an empty database

4.2.7 <Temperature Set-up> Button

With this tabbed dialog box, the color scale's palette, which appears in the thermogram, can be configured. To select colors, click on the RGB colors. <Scales> sets the number of colors to be included as the major palette colors. Colors may be blended by selecting the <Color progression> option.

The <Range> value defines the scale range of the temperature difference view.

Attention: The settings for the minimum and maximum temperature must be within the DEDTMP50HR scanner measurement range of 100°C (212°F) to 650°C (1202°F)!

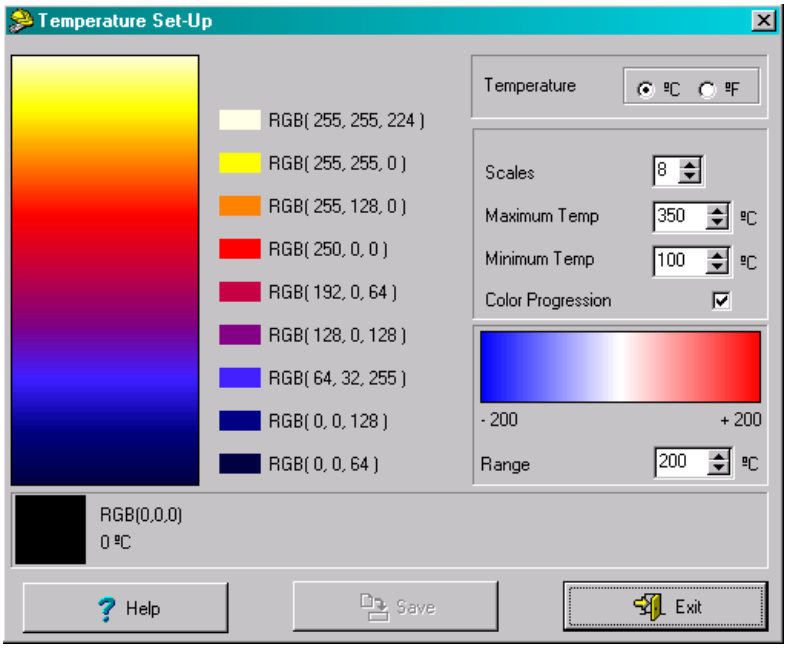


Figure 26: Temperature Set-up Dialog

4.2.8 <Refractory> Button

With this tabbed dialog box the refractory management is configured (material in the interior of the kiln, description of each type, thermal conductivity, installation date and comments to each type). In the main program, the description of the refractory appears in the <History> display on the temperatures graph.

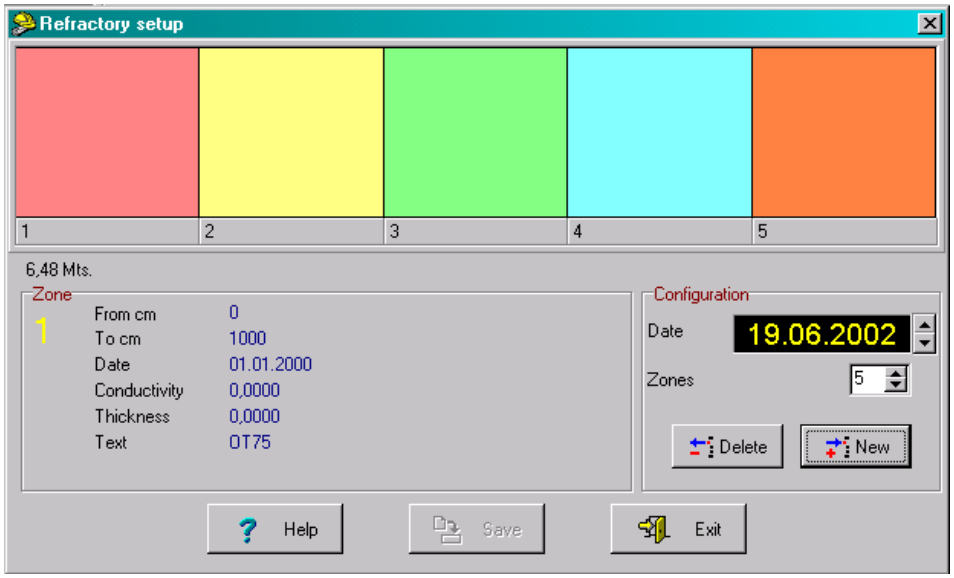


Figure 27: Refractory Set-up Dialog

By double clicking on a colored area, a dialog box for setting the zone parameters appears.

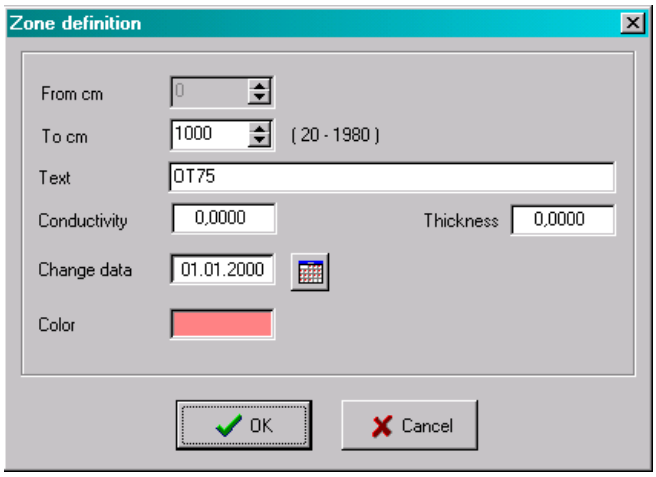


Figure 28: Definition of a Refractory Zone

4.2.9 <Fan alarms> Button

With this tabbed dialog box, the fans can be configured with the following parameters:

- definition of the fan zone (the starting point is unchangeable, it is identical to the end point of the previous zone)
- date of the last change,
- temperatures for switching on and off
- description for the fan,
- the corresponding output channel

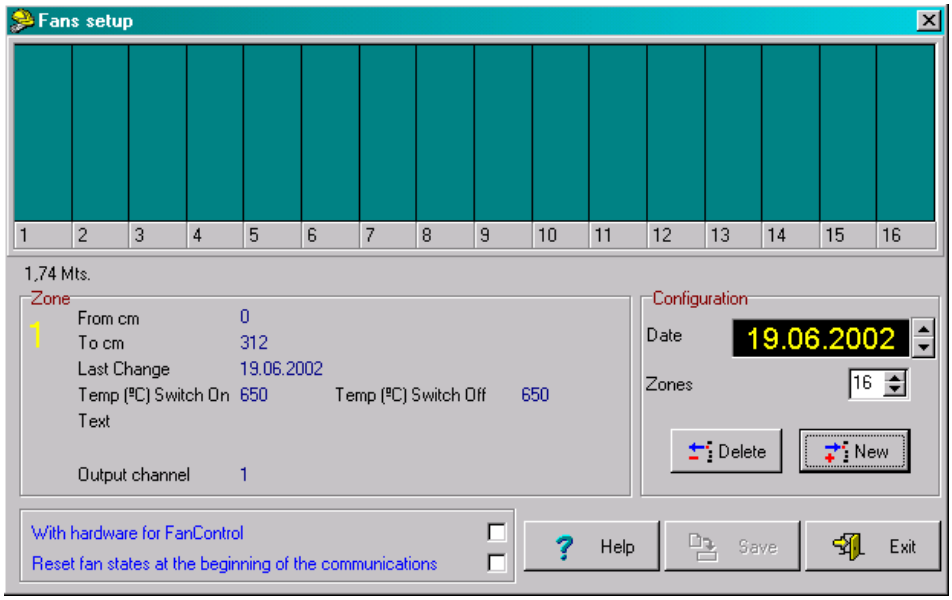


Figure 29: Fans Set-up Dialog

For the first Fan Setup setting it is necessary to click on the <New> button for creating a new configuration. Only in this way it is guarenteed that a valid data format is used. Otherwise a mismatch between the preset data format and the systems data format can be occurred.

If an appropiate output hardware is installed, the option <With hardware for FanControl> is to be enabled. For that after the starting up of the CS100 software the program for controlling the fans (fancontrol.exe) is invoked automatically. For more detailed information see section 7.1 Cooling Box for Protective Housing on page 43.

By double clicking on a colored area, a dialog box for setting the fan zone parameters appears.

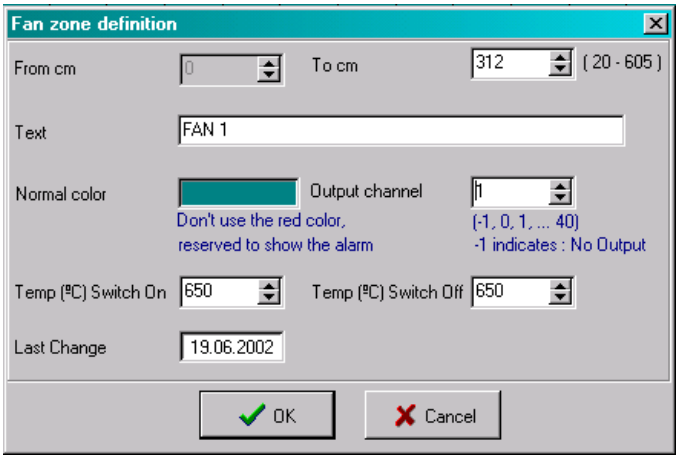


Figure 30: Definition of a Fan Zone

4.2.10 <CRaytek> Button

Because the scanner send a line of temperatures in accordance with the needs of DataTemp CS100, the scanner must be configured to provide the expected information. With the following tabbed dialog, the sent commands to the scanner can be added, modified or deleted.

Attention **It is not recommended to change any commands without grave problems! Otherwise the whole system can be suspended. The emissivity setting is described in detail in chapter 4.6 Emissivity Settings on page 30.**

If it is necessary to configure the scanner, a few preset commands are sent via the serial communications line. Realize the following steps:

1. Select the requested port and the PC's baud rate according to the scanners baud rate. Open the port.

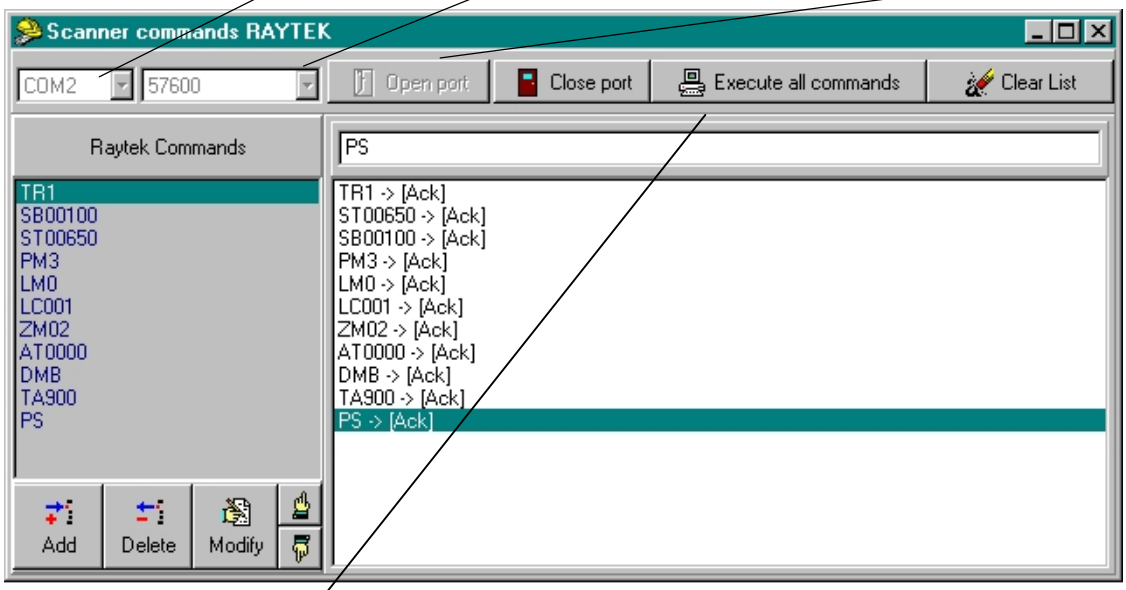


Figure 31: Scanner Command Dialog

2. By clicking the button <Execute all commands>, all setup commands are sent to the scanner. More detailed information to the commands is to be found in the *Protocol Manual*.

- TR1 full measurement range
- SB00100 100 °C (212 °F) as the bottom temperature to be measured
- ST00650 650 °C (1202 °F) as the top temperature to be measured
- PM3 256 pixels per line
- LM0 data returned without sector values appended
- LC001 line count 1
- ZM02 external trigger
- AT0000 no averaging
- DMB data format in bytes
- TA900 transmission factor 0.9 for the second IR-window
- PS store all parameters in the scanner

3. The scanner has to respond to each command with the acknowledgment [Ack]. Otherwise an error is occurred. In that case the communication line, the used port and the baud rate are to check. Afterwards the whole command list is to send again.

4. Close the port.

Note Starting with the software revision 2.54 the commands are sent automatically to the scanner after starting DataTemp CS100.

4.3 User Configuration

The User Configuration program allows the user's access/rights to be added, deleted and modified. Various access levels exist to avoid changes of the configuration by users that do not have the right to configure the system.
To configure the system's user select the start menu, activate the CS100 program group and click on the icon <User Administration>. Afterwards a window for inquiring of the password appears. The preset parameters are:

User: ***ROOT*** Password: ***Qwerty*** (Upper case ***Q*** and lower case ***werty***)

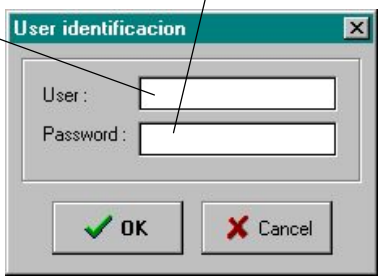


Figure 32: User Identification Dialog

Note: It is also possible to use the factory preset passwords with User: a , Password: a . This passwords are also valid for the main program module.

Once the user has been correctly identified, the following mask appears:

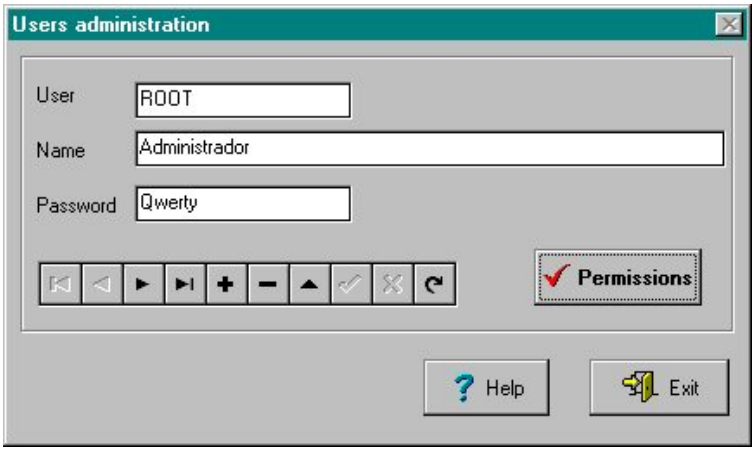
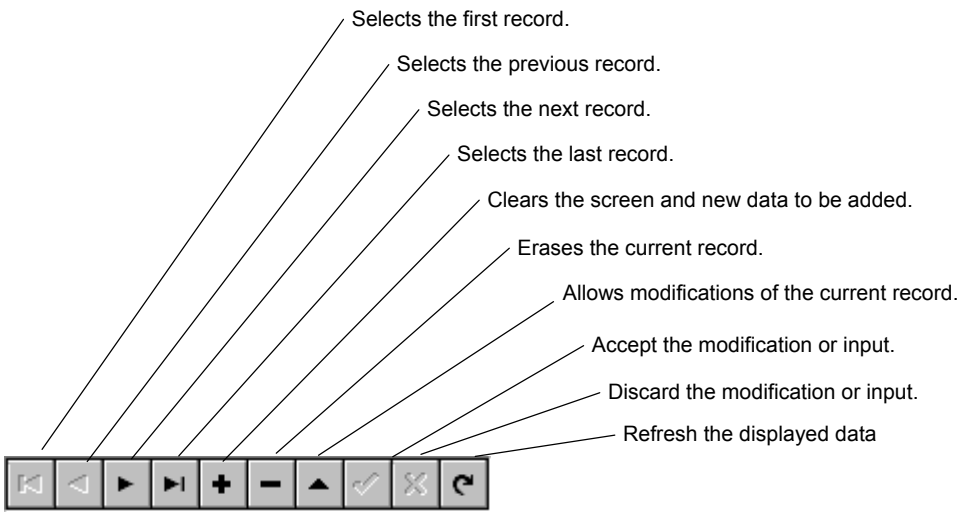


Figure 33: User Administration Dialog

A button bar allows users to enter, modify and erase records (users). The same button bar exists under the Permissions (same functionality).

The buttons have the following functionality:



4.3.1 Entering a Record

When clicking on the button with the <+> icon, the data on the screen disappears and one can enter new data. Once the input is complete, click the accept button with the <✓> icon. To discard the inserted data, click the button with <X> icon. When the input is accepted, the data will be stored in a table and cleared from the screen to allow new records to be added.

4.3.2 Erasing a Record

To erase a record click on the button with the <–> icon. Once confirmed, the data will be erased of the table.

4.3.3 Modifying a Record

Click the <▲> icon: one may now modify the data. The modifications will be changed by clicking on the accept button <✓>; or discarded by clicking the discard button.

4.3.4 Access Permission to other Program Modules

Click on the <Permissions> button and the following screen appears:

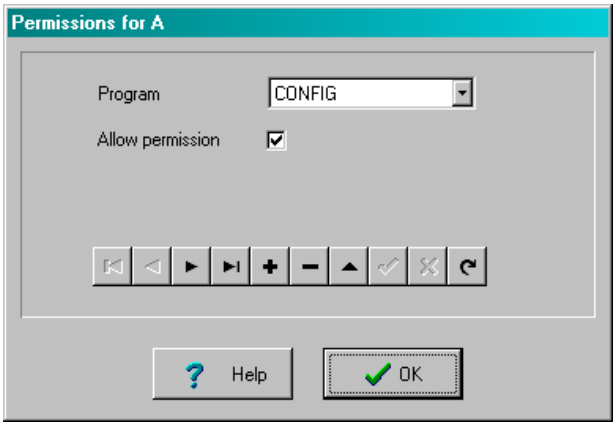


Figure 34: Permissions Dialog

In this dialog box, the permissions of the three programs are given to each user. To enter the permissions, click the button with the <+> icon. The data fields will be cleared. Select the program for which access is to be given. Choose the function level (an asterisk indicates total control). Finally, activate the permission with a cross in <Allow permission> check box. When clicking on the accept button (with the <✓> icon), the data is recorded in the table. Now it is possible to enter more permissions.

4.4 Hardware Alarm Outputs

Hardware alarm outputs can be provided using optional Fan Control Hardware. One or more hardware alarm outputs can be configured via Fan Control hardware and software, but this alternative requires the optional Fan Control Hardware package (software is provided as part of the CS100 System). One or more hardware alarm outputs can be implemented by configuring outputs (DO 0 up to DO 15) of the Digital Output Module 7043D (see appendix 8.10 on page 70) to correspond to desired zone temperature limits specified in section 4.2.4 <Alarms> Register on page 18. Alternatively, one "alarm zone" could be configured to include the entire length of the kiln.
The following steps describe how to implement hardware alarm outputs using Fan Control hardware and software:

1. In the CS100 Configuration program, click Fan Alarms to view the Fans Setup page.
2. Configure each Fan Zone to correspond to the desired alarm zone(s), which may correspond to the temperature limits specified in section 4.2.4 <Alarms> Register on page 18.
3. Set the "Temp Switch On" and "Temp Switch Off" values to correspond respectively to the desired upper and lower temperature alarm values for each specified output channel number.
4. Save values and Exit the Configuration program.

4.5 Fail Safe Hot Spot Alarm - Setting of a Sector Alarm

To increase the reliability of monitoring it is necessary to guarantee a fail safe hot spot alarming also in case of a PC or software crash. For that the scanner provides an internal alarm relay. The relay contacts are available with a 15-pin D-connector at the front panel of the interface box. The internal relay connects pin 1 and 2 in case of no alarm, pin 2 and 3 in case of alarm. The contacts are potential free, the maximum load is 30 V / 1 A.

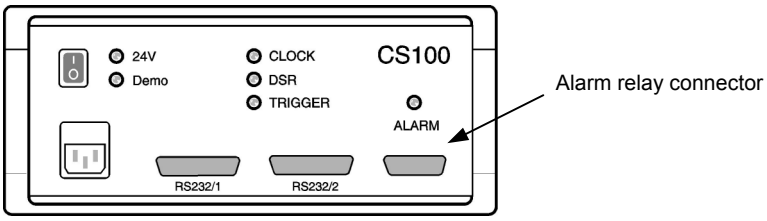


Figure 35: Front Panel of Interface Box

The following example shows the procedure for sector 1 to detect a hot spot greater or equal 400°C within a 90° field of view:

1. Close the DataTemp CS100 main program (if it is running).
2. Open the DataTemp CS100 Configuration program.
3. Select the <Craytek> button.
4. Select the COM port, where the scanner is plugged in and choose the right baud rate.
5. Open the COM port by clicking on the <Open port> button.

6. Set the cursor to the top white editable line, all inputs require capital letters!
7. Type **SL1000** and push the <Add> button. // *left starting point of sector 1 at 0°*
8. Type **SR1900** and push the <Add> button. // *right starting point of sector 1 at 90,0°*
9. Type **SC12** and push the <Add> button. // *find maximum in sector 1*
10. Type **TB10000** and push the <Add> button. // *turn off the bottom alarm threshold*
11. Type **TT10400** and push the <Add> button. // *alarm when result is greater or equal 400°C*
12. Type **TM11** and push the <Add> button. // *set sector 1 to alarm for a time*
13. Type **TZ19999** and push the <Add> button. // *time for holding alarm 999,9 sec*
14. Select the **PS** command in the already existing command list by clicking with the mouse, click on the "hand down" key to move the PS command to the end of the list. This ensures the availability of the added commands also after a scanner's switching off and on without the need to restart the <Craytek> tool of the configuration program.
15. In the result the following command list must be displayed:
    SL1000
    SR1900
    SC12
    TB10000
    TT10400
    TM11
    TZ19999
    PS
16. Click on the <Execute all commands> button to make the added commands valid, as the result you must get for each command an ACK (acknowledgement).
17. Close the COM port by clicking on the <Close Port> button.
18. Click on the <Clear list> button to clear the command list on the screen.
19. Choose COM port and baud rate for the second scanner, if any. Open the COM port, click on the <Execute all commands> button, close the COM port.

Of course it is possible to adapt the temperature alarm limit (which is set to 400°C in the example above), the sector width (which is set to 0° - 90° in the example above) and the time for holding alarm (which is set to 999,9 sec in the example above) to the specific requirements of the application. Please make sure that this is really the emergency temperature alarm limit. For early warning please use lower levels with the standard alarm functions available in the CS100 Configuration software.

4.6 Emissivity Settings

The emissivity value for the oxidized steel surface of the kiln must be adjusted in the software. The standard scanner setting after delivery is 0.95. Oxidized steel has an emissivity value of about 0.7 to 0.9 (see the Operator Manual for the scanner). The scanner has 4 internal different emissivity settings. For a correct setting all emissivity values must be changed. Follow the steps below to set the emissivity to 0.8:

1. Close the DataTemp CS100 main program (if it is running)
2. Open the DataTemp CS100 Configuration program
3. Select the <Craytek> Button
4. Select the correct COM port, where the scanner is connected and choose the baud rate
5. Open the COM port by clicking on the <Open port> button
6. Set the cursor to the top white editable line and type SE0800 (only capital letters!)
7. Push the <Add> button to add that command to the still existing command list
8. Type **SE1800** and push the <Add> button
9. Type **SE2800** and push the <Add> button
10. Type **SE3800** and push the <Add> button
11. Select the PS command in the command list by clicking with the mouse, click on the "hand down" key to move the PS command to the end of the list
12. In the result the following command list must be displayed:
    TR1
    …
    TA900
    SE0800
    SE1800
    SE2800
    SE3800
    PS
13. Click on the <Execute all commands> button, as the result you must get for each command an ACK (acknowledgement)
14. Close the COM port by clicking on the <Close Port> button
15. Click on the <Clear list> button to clear the command list on the screen
16. Choose COM port and baud rate for the second scanner, open the COM port, click on the <Execute all commands> button, close the COM port

Now you have set the emissivity setting to 0.8.
If you need an emissivity setting of 0.75 for the scanners you have to use the commands
SE0750
SE1750
SE2750
SE3750

4.7 Language Configuration

4.7.1 Adding or Modifying a Language

By means of the Language Editor more languages can be added into the CS100 software. It is also possible to modify the existing languages.

1. Start the <Language editor> module in the start menu of the CS100 program group.
2. The Language Editor opens the file *DATATEMP.STM* containing the languages, which already exists. A table appears on the screen, in which every column contains a complete language version.
3. Add a new language version by clicking the menus <Language> <Add>.
4. Choose an existing language as the template for the new language version.
5. Step-by-step editing of the separate entries of the new language version.
6. Save of the changes by means of the menu <File> <Save>.

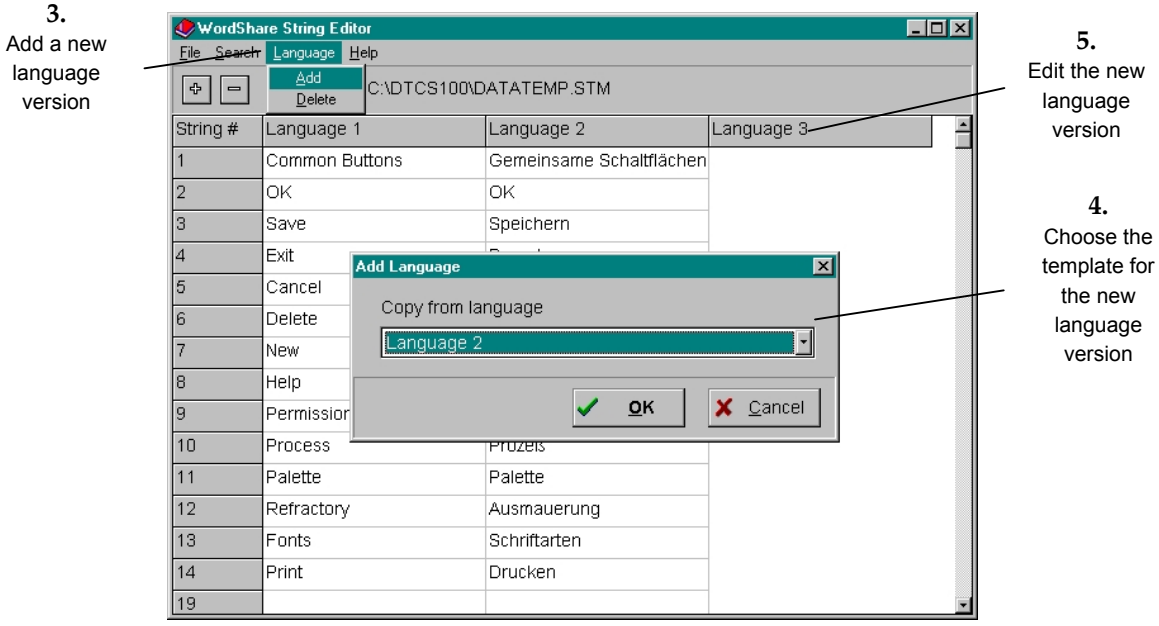


Figure 36: The Language Editor

Attention: Before exiting the program, be sure to save your changes as the program does not automatically prompt you to save as most programs normally ask.

5. Operation

The main program is to start by means of the menu item <DataTemp CS100> in the program group. After the selecting the menu item <File> <Open> <Realtime>, a dialog box for setting the communication to the scanner appears automatically. See the following section.

5.1 Setup Communication

The communication between PC and scanner is setup by the program module READSCAN, which is activated automatically with the menu item <File> <Open> <Realtime> in the main program. READSCAN may also be started by means of the corresponding item in the CS100 program group in the start menu.

READSCAN opens the following dialog box. As it comes up, it shows the current communication status. Before establishing the communication the necessary parameters must be set by means of the menu item <File> <Setup>.

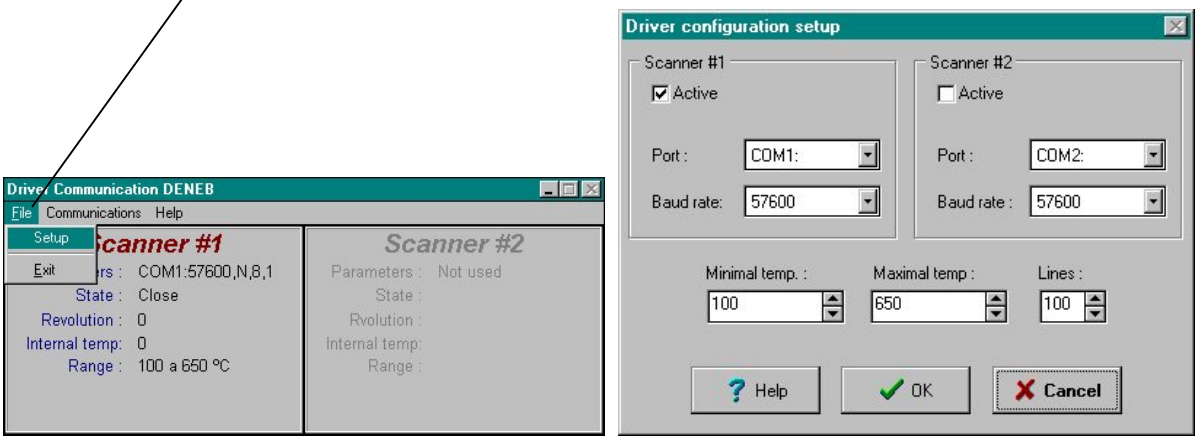


Figure 37: Setup of Communication Parameters

All parameters must be set according to the scanner configuration. The minimum and the maximum temperature must match with the scanner's temperature range as set by the command in the <Craytek> button, see section 4.2.10 <CRaytek> Button on page 24. Lines must be set to the number of lines per revolution which are set in the trigger box. After setting of all parameters, the communication is ready to be opened with the menu item <Communications> <Open>.
An established communication is to check by means of the communication state. Additionally the internal temperature should show the current temperature of the scanner's inner.

5.2 Realtime View

The Realtime view allows the users to view current temperatures. The data will appear after a full rotation of the kiln has occurred. To open a Realtime window, select the menu items <File> <Open> <Realtime>.

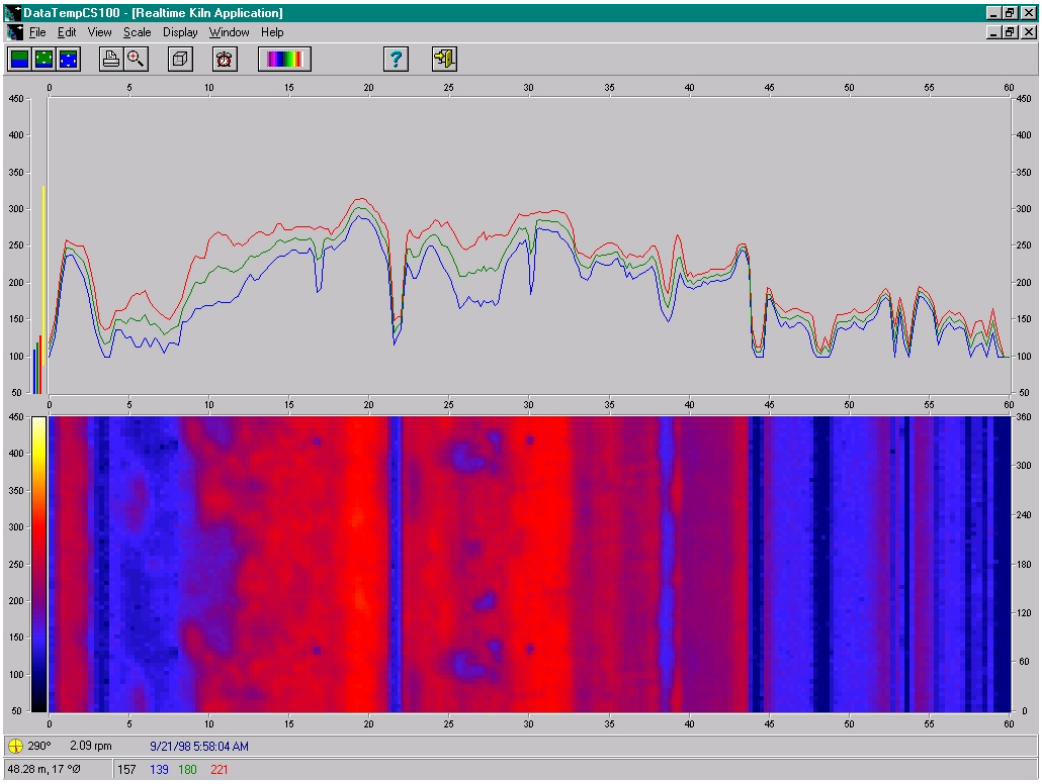


Figure 38: The Realtime View

Once the window is open, the kiln temperature data can be viewed as either a profile or a thermogram or both (dual) by clicking on the following icons:

Alternatively, the Realtime window can be configured by using the menu item <Display> in conjunction with sub-items <Dual|Profile|Thermogram>.

5.2.1 Profile

With the realtime profile window (which can be selected with <Display> <Profile>), temperatures across the kiln are displayed in a graph with the Y-axis being temperature and the X-axis being position.

The kiln temperatures are plotted as the average (green line), maximum (red line) and minimum (blue line) of a full kiln rotation. By positioning the mouse pointer on any point on the graph, the corresponding values of average (green text), maximum (red text) and minimum (blue text) appear on the bottom of the real-time window. The corresponding location of these values (black text) also appears in the bottom left corner of this window.

Near the bottom of the realtime window, the data acquisition status appears as a yellow circle with a red line moving counter-clockwise to simulate the kiln rotation. To the right of this status indicator appears the kiln frequency followed by the date and time.

At the left of the profile, vertical bars represent the average temperature (green bar), maximum temperature (red bar), minimum temperature (blue bar) and alarm limits (yellow bar) or the current mouse cursor position (or the last position before the mouse left the window).

Note: The location of the X-axis and Y-axis labels, in addition to the profile scales (the vertical bars) and the alarm zones (not shown above) can be configured by the Software Configuration Utility. If the profile bars do not appear, the configuration may be adjusted to make the bars appear.

5.2.2 Thermogram

With the realtime thermogram window (setup as menu items <Display> <Image>), temperatures for the whole kiln are displayed in a thermogram. (A thermogram, in this case, appears as though the kiln was sliced along its length and laid flat with various colors representing its different temperatures.)

When positioning the mouse cursor on any point on the thermogram, the corresponding 'ring' values of average (green text), maximum (red text) and minimum (blue text) appear on the bottom of the real-time window. The location (black text) corresponding to the mouse cursor appears at the left of these values.

Here again, near the bottom of the Realtime window, the data acquisition status appears as a yellow circle with a red line moving counter-clockwise to simulate the kiln rotation. To the right of this appears the kiln frequency followed by the date and time.

A temperature scale can be displayed near (and removed from) the thermogram by clicking on the palette icon

or with the menu items <Scale> <Visible>.

This temperature scale can be dragged over the image to more easily determine temperatures at specific locations within the thermogram.

Note: The location of the X-axis and Y-axis labels, in addition to the thermogram color scales are configured by the Software Configuration Utility. Also, the color scale can be changed to reflect user defined colors.

5.2.3 3D - View

The real-time kiln temperature data can be displayed as a 3D-contour graph. This can be very easily done by selecting the icon:

The following screen appears:

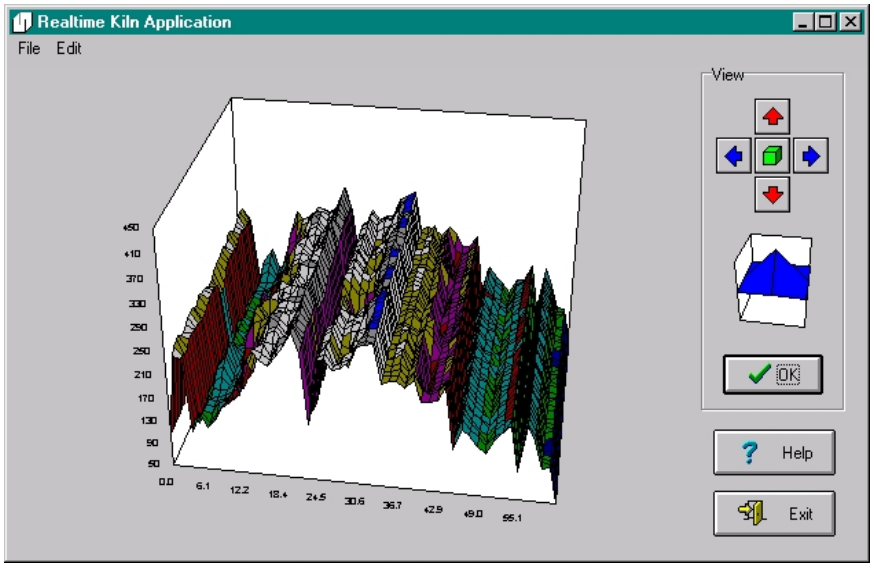


Figure 39: The 3D - View

The red and blue arrow buttons rotate the 3D contour. After using the arrows, select the OK button to incorporate the new view. The icon

will toggle on/off the coloring of 3D contour.

5.3 History View

With the history screen (menu items <File> <Open> <History>), it is possible to view data of one day that comes from the historical database. This view functions just like the realtime view with a few minor differences. The biggest difference is that there is no longer a rotation status indicator. The status indicator is replaced by the kiln temperature data's date/time. In opposite to the realtime view, in the history view the profile is added with a colored line characterizing the settings of the refractory management. By moving the mouse the entries of the corresponding zones may be displayed in detail.

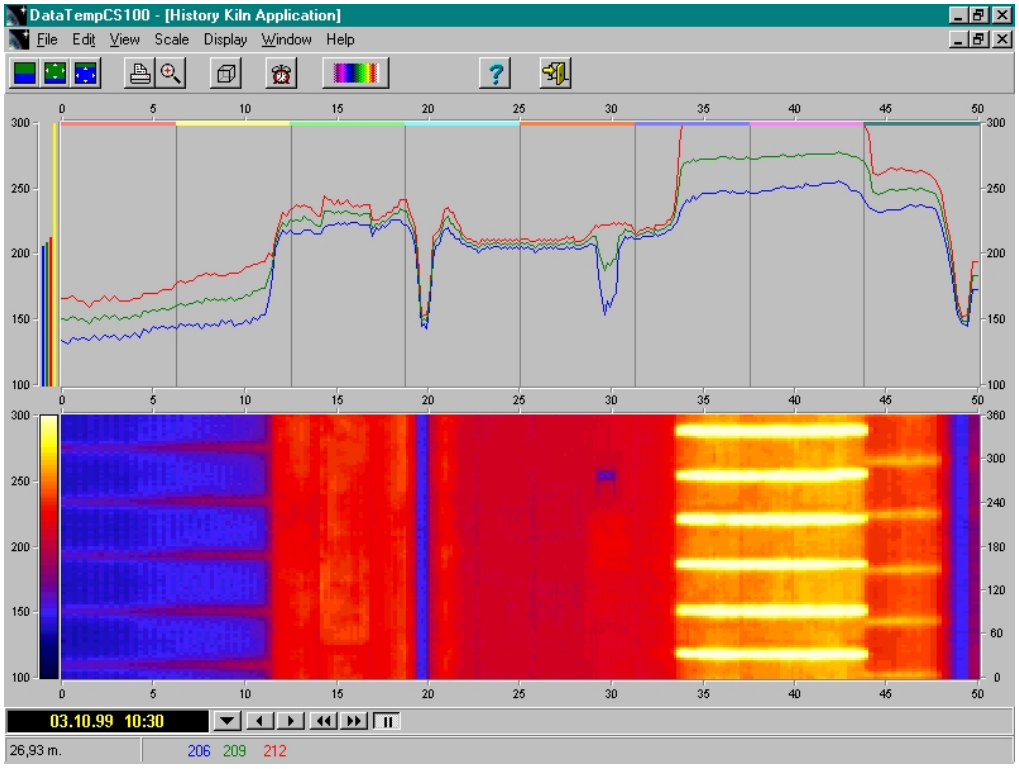
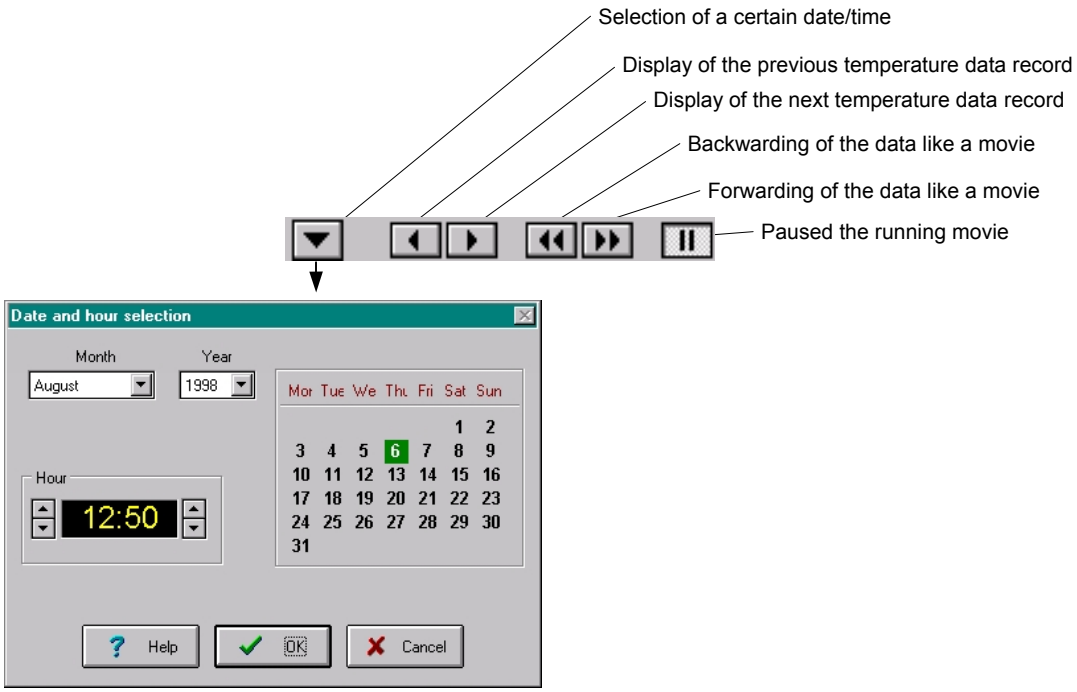


Figure 40: The History View

The icons to the right allow changing of the date/time:



5.4 Day History View

The day history view displays thermograms across a certain number of days. One thermogram in the day history view is the average of all thermograms of a day. The day history view functions just like the history view described above.

5.5 Zoom

Selecting menu items <View> <Zoom> or clicking on the magnifying glass icon

will open the zoom window:

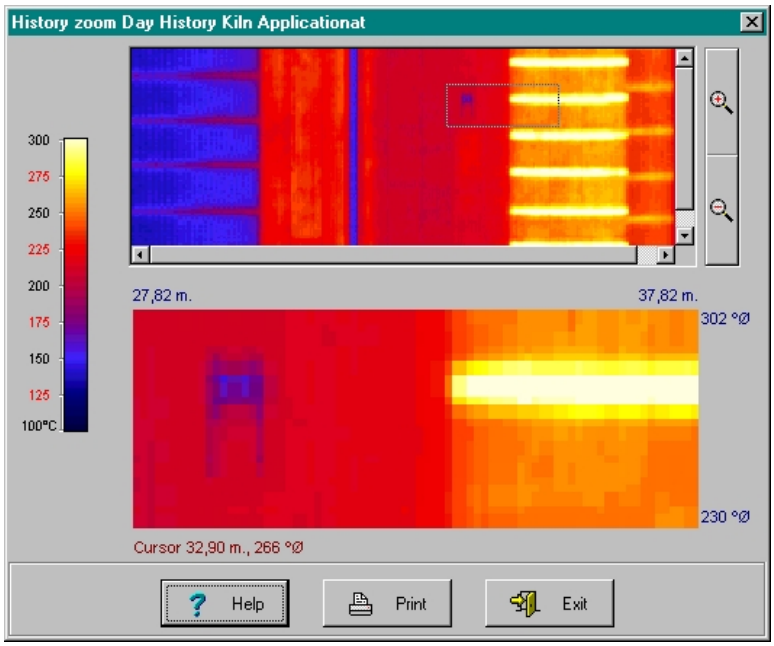


Figure 41: The Zoom View

When the mouse is clicked and moved over the image, the cursor becomes a box. This box is area of the image that gets enlarged when the left mouse button is clicked. The enlarged picture is formed below the kiln image. The magnify icons shrink or enlarge the original thermogram too.

The scroll bars can be used to access hidden thermogram parts. This information can be printed with the print button.

5.6 Alarm

Selecting the menu items <View> <Alarm> <Zones>, the alarm zones and limits appear on the profiles of the active window (history or realtime). When the alarm is triggered by a profile above or below the alarm levels, the sound is turned off with the clock icon:

Note: The system manager can setup the alarm zones and the upper and lower alarm limits within the Software Configuration Utility.

5.7 Difference of Temperatures

A thermogram (history data only) can be subtracted from another with the menu items <View> <Temperature> <Difference>. Use the down arrow icons to set the date/time for each image and then select the <Process> icon. A map will appear with the differences between the sets of recorded kiln temperatures. Clicking on the print button will produce a hardcopy version of this view.

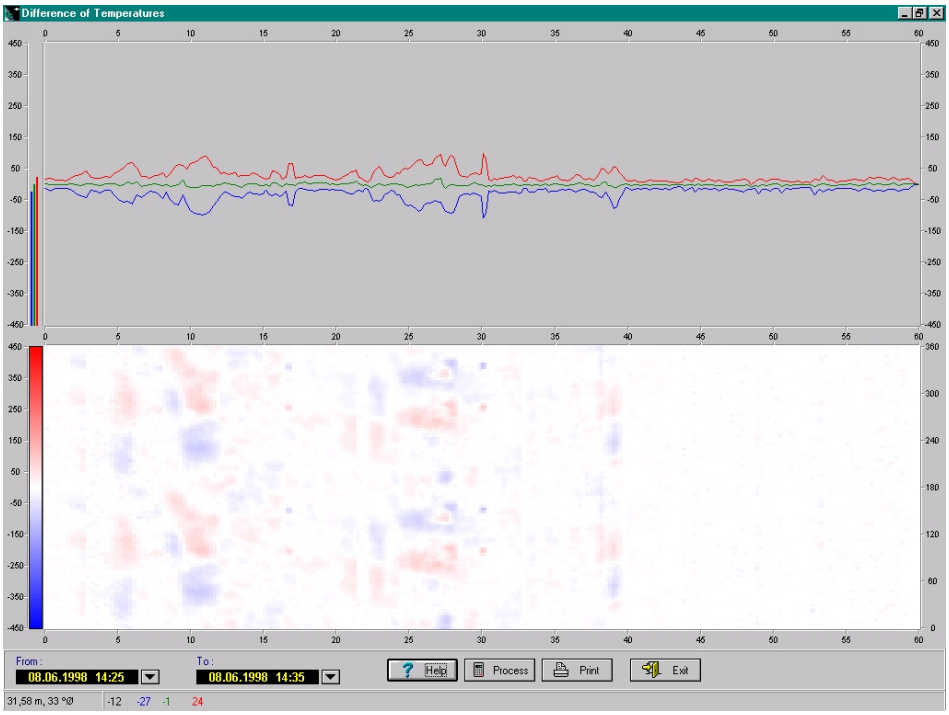


Figure 42: The Difference-of-Temperatures View

5.8 Trending

This function is only available in the day history view. The Trending function illustrates the temperature variation of the minimum, the maximum, and the average over a certain time in a 3D-view. The temperature variation is related to a definable area, which must be preselected in the thermogram view by using the right mouse button.

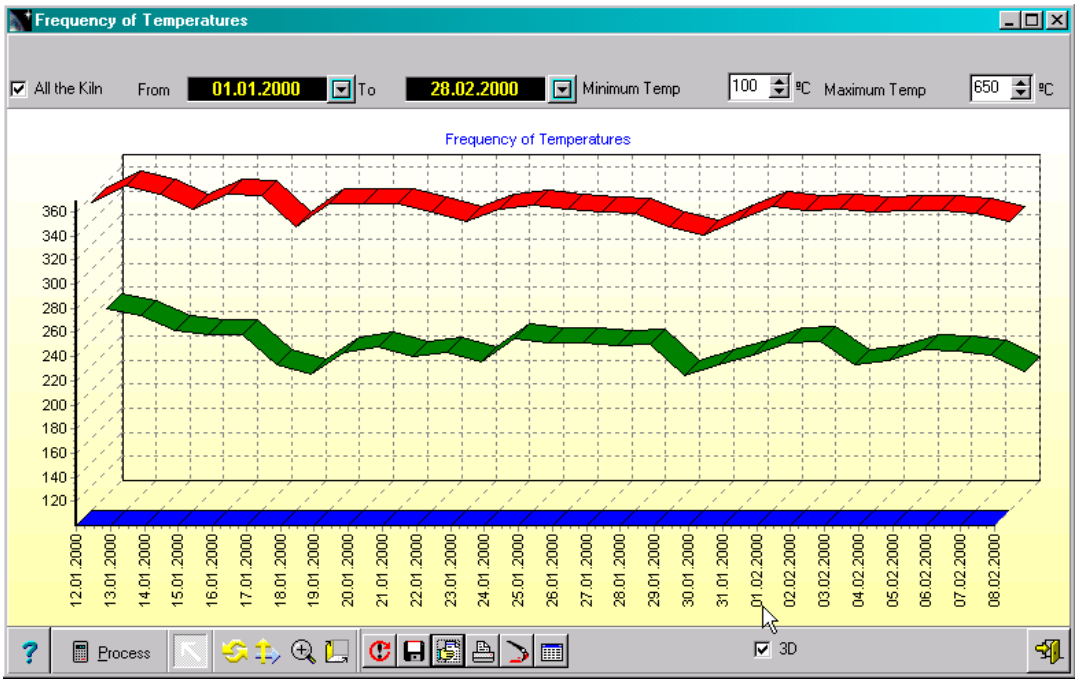


Figure 43: The Trend View

5.9 Histogram

This function is only available in the day history view. The Histogram function shows the number of the measured temperature values for a certain time related to the whole kiln or to a definable zone.

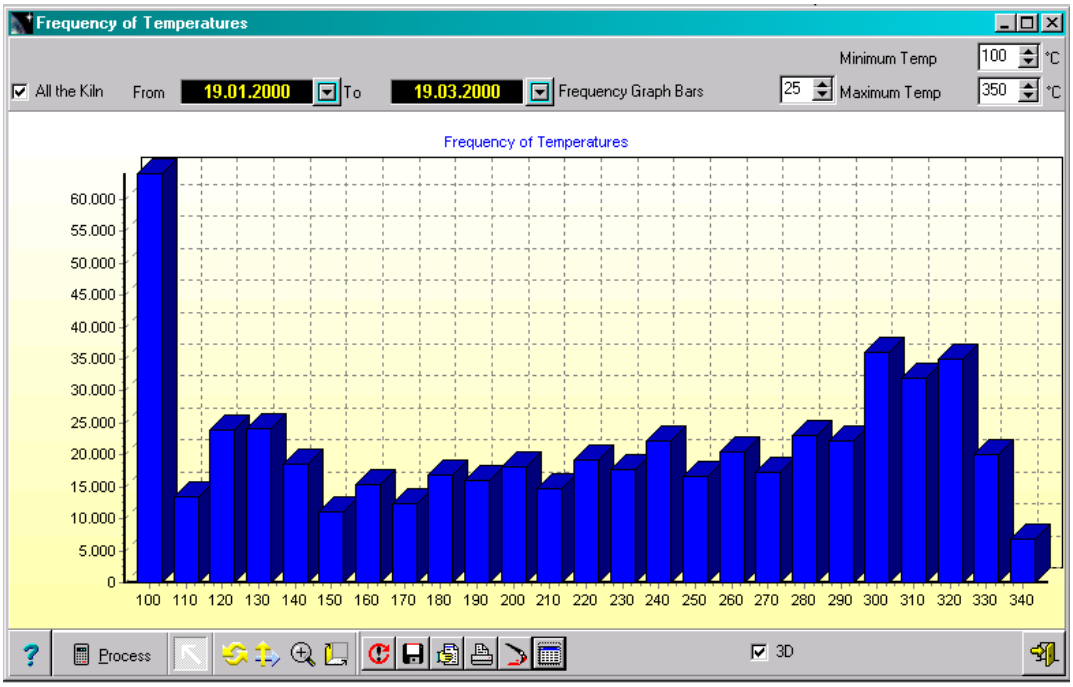


Figure 44: The Histogram View

5.10 Printing

Printing can be done quickly with menu items <Edit> <Print> or by clicking on the printer icon. Immediately, the active window is sent to the printer.

Note: If there are multiple printers on the system, it is needed to configure which printer is to be used in Control Panel's Printers program. (The default printer can be set by selecting the printer icon and choosing <File Set> As Default. Printer properties can also be set here with <File Properties>.)

5.11 Exporting Data

The temperature data may be exported to other programs in a text format or by screen capture/copying. This section describes ways of exporting data.

ASCII Text:

The menu items <Edit> <Export> will copy the ASCII values of minimum, average and maximum profiles (256 sets of 3 temperatures) of the active window (realtime or historical view) into a file that is to name. This file may later be exported into a program such as Excel or MathCad.

Clipboard copies:

There are 3 ways that screen portions can be copied to the clipboard. Once screen shots are copied to the clipboard, it is to switch to other applications (such as Excel, Word Paint or PowerPoint) and 'paste' the clipboard into the requested application. (Check the documentation of the target application to see how to paste the clipboard into it.)

<Print Screen> Key

When pressing the print screen key, Windows NT copies the entire contents of the screen to the clipboard.

<Edit> <Copy> Menu Item

The menu items <Edit> <Copy> will copy the active window within the program to the clipboard. Thus, if the screen displays the Realtime and Historical views and the Historical view is active, the contents of the historical window are copied to the clipboard.

<Alt> <Print Screen> Key

By using the <Alt> <Print Screen> keys in combination, the active application window is copied to the clipboard. Thus, if the active program is only using half the screen, only this portion will get copied to the clipboard (and the rest of the screen is not transferred to the clipboard).

5.12 Exiting the Program

Exiting this program is possible by means of the menu item:

To secure critical data the exiting of the program is protected with a password. Closing the communication should be considered when leaving this program for a long period of time.

6. Troubleshooting

Symptom	Possible Cause / Solution
A scanner was connected, but the communication between scanner and program could not be established.	• Check the wiring of the whole system (use of shielded cable, use of twisted pairs cable, correctly fitted connectors, cable damage), for recommended cables see section 2.6 Cables on page 6. • Check the power for the scanner (red LED on scanner's backside is "on"). The power for the scanner should have 20 VDC in minimum at the connection box close to the scanner's location. • Verify correct COM port. Function of COM port can be tested by using another serial device (e.g. a mouse). Use the PC's onboard COM port (problems could be with multi serial COM plug-in cards)! • Avoid to use USB/RS232 converters! • Check the rotation of the internal scanner mirror assuming the power is on (viewing or hearing test). • Avoiding scanner overheating. Maximum internal housing temperature: 60°C (140°F). The internal housing temperature is displayed in the status bar of the scanner software. • In case of the scanner's cooling, check for condensation in the scanner's housing → condensation can cause the total outage of the unit. To avoid condensation see the according section in the MP50 manual. **Note: The scanner can be checked directly in the field by means of the communication interface in the connection box with the software tool "Pcomm.exe" to be found on the CD.**
The screen shows black, unstable, or incomplete thermogramms.	• On some computers, the performance of the software can be increased dramatically by switching off the hardware graphic acceleration: Windows 2000: <Start> <Settings> <Control Panel> <Display> <Settings> <Advanced> <Troubleshooting> <Hardware acceleration>: None • The system has lost the synchronization due to missing signals from the position indicator: ○ Check alignment and distance between trigger bar and position indicator. ○ Increase the metal mass of the trigger bar for a reliable signal generation. ○ Check the wiring. ○ In case of trigger problems, the error should disappear by of switching the system to the DEMO mode, section 8.5 Interface Box Settings on page 65. **Note: The trigger signal can be checked by means of blinking LED's on both the connection box (located close to the position indicator) and the interface box in the control room.** • Check the correct blinking of the LED's of the interface box, see section 3.5 Interface Box, on page 13. A too slow speed of the kiln (default threshold: 0.5 rpm) switches the CS100 system to the non-synchronized mode (simultaneous blinking of the DEMO LED and the CLOCK LED). This is a normal behavior. • Ensure that the switch S3 in the interface box is set to "online" and the corresponding switches S1 and S2 are set to 0 (100 lines), see section 8.5 Interface Box Settings, on page 65. • Uninstall/reinstall the CS100 software (take care for the deneb.ini, the *.log files and the bdDENEB.mdb) • Use another PC or laptop (exclude DSR problem) • CS102: ensure that scanner 1 is the left scanner and scanner 2 is the right scanner • CS102: exchange the COM ports (now: scanner 1 at COM1, scanner 2 at COM2, later: scanner 1 at COM2, scanner 2 at COM1) • CS102: try to run the system as a single-scanner system temporally

Troubleshooting

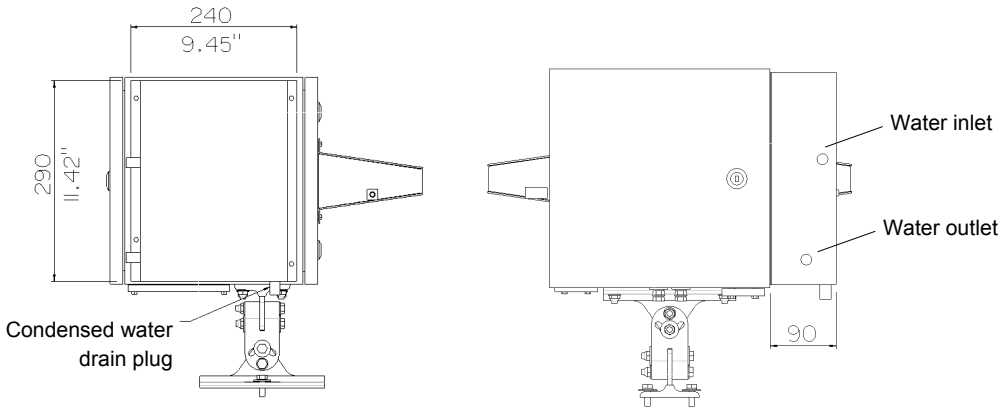
Symptom	Possible Cause / Solution
Communication problems occur from time to time.	The reason is due to communication errors during the transfer of temperature lines. Possible solutions are: • Mount the cables away from motors or heaters that produce strong electrical fields. • In some cases the graphic card of the computer can interrupt serial communications for too long a time. S3-graphic cards are known to exhibit this problem. The only solution is to exchange the S3-graphic card. • To avoid communication problems the properties of all used COM ports must be changed as follows: Windows 2000 Systems: <Start> <Settings> <Control Panel> <Hardware> <Device Manager> <Ports (COM & LPT)> <Communications Port COM1> <Ports Settings> <Advanced> <Receive Buffer>: Low
Database access problems	• MS Access must be installed on the PC • Maximum database size violated (Access 97: 1 GByte, Access XP: 2 GByte) • A networked database must come with full access rights from the operating system • Restart the CS100 system with an empty database • In case of a networked database, try to place the database temporally on the local drive C temporally
Erroneous temperature values are displayed.	• Dirty measurement window • Field of view obstructed • Wrong emissivity setting
LRM problems	• Use only Raytek supplied position indicators! • The master position indicator must be wired to the "Kiln trigger" labelled input on the LRM board (remote control unit). All subsequent indicators must be wired to the inputs "Tire 1", "Tire 2" and so on without skipping an input. • In the LRM software under <File> <Configuration> set the parameters <N' Sigma> and <Max. statistic points> down to 1 temporally.

Note: An installation/trigger problem can be checked using the scanner in the control room close to the interface by using standard scanner spare cables for power, trigger and RS-485 (there is an extra SUBD25 connector on the backside of the interface box).

Note: Every system actions and problems are documented in the **.log** files located in the DataTemp CS100 directory. It is possible to get a quick help from Raytek service by sending all **.log** files together with the customer configuration file **deneb.ini** to Raytek by e-mail.

7. Options

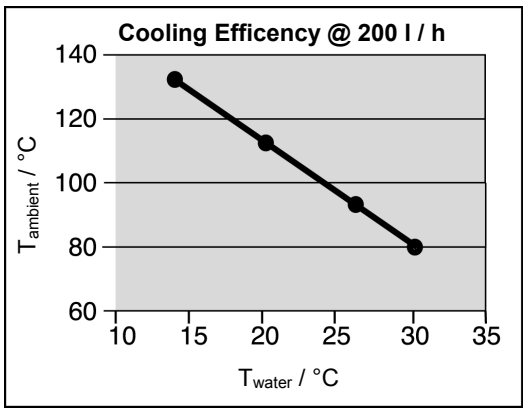
7.1 Cooling Box for Protective Housing

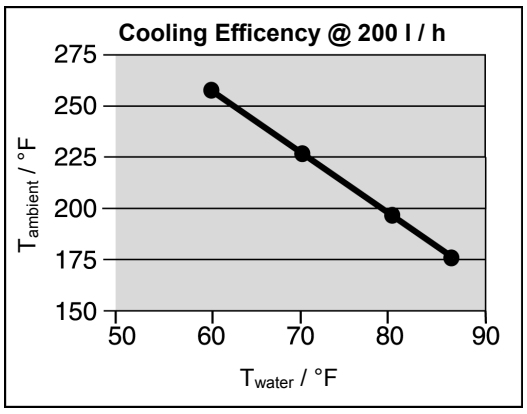


Part No.	Description
XXXSYSPHCO	The protective enclosure is available with a cooling box. This cooling box was created to reduce the enclosure internal temperature caused of direct sunlight or high ambient temperatures. The ambient temperature range for enclosures with the cooling box is exceeded up to 110°C (230°F). The bottom ambient temperature is reduced in case of direct sunlight. The cooling box consists of an air to water heat exchanger with a housing material of stainless steel. The cooling box is not suited for applications other than use with kilns.

Technical Data:

Ambient temperature	40°C to +110°C (104 to 230 °F); at flow rate of 200 l / h @ 20°C (68°F) water in
Cooling power	200 W; at flow rate of 200 l / h @ 20°C (68°F) water in
Power supply	24 VDC; 2.5 W
Air throughput rate	50 m³ / h
Dimensions	B 240 mm, H 290 mm, T 90 mm
Water connector	∅ 10 mm / max 6 bar
Box	Stainless Steel 1.4301





7.2 Fan Control

The Raytek CS100 Fan Control system will enable the operating personnel to automatically turn on or off 16 fans in up to 40 user set control zones.

In order to ensure lining durability and avoid kiln deformation during normal operation, kilns may require additional cooling from fans.

The hardware consists of a controller unit (rail mount) with 16 digital outputs (open collector 30 V / 100 mA), RS485 serial interface, RS485 / RS232 converter & 24 VDC power input, for wiring see appendix 8.8 Two Scanner Installation with LRM and Fan Control on page 70.

The software DataTemp CS100, will allow 16 independently adjustable hardware alarm sectors.

After starting the CS100 software the Fan Control software is invoked automatically assuming the enabled check box <With hardware for Fan Control> on the <Fans setup> page in the configurator. A screen is available for setting each fan automatically or by hand:

– **Auto**: The fan is automatically controlled by the CS100 software.
The status of the fan is listed in the database bdDeneb.mdb.
Afterwards the FanControl software retrieves that information.

– **On**: turns the fan On, database will be ignored

– **Off**: turns the fan Off, database will be ignored

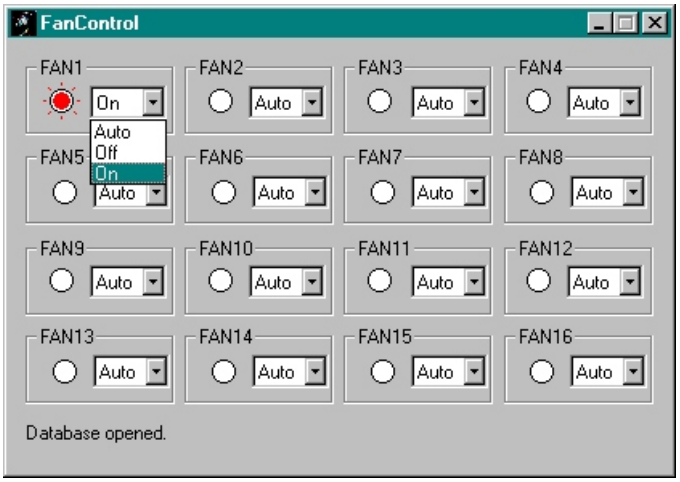


Figure 45: Set-up of Fans

Note: To trigger a fan output, the fan alarm must be valid at least over one whole revolution of the kiln. After closing the CS100 software the Fan Control software is closed automatically. For safety reasons Fan Control can not shut down on its own.

7.2.1 Installation

Delivery for Fan Control:

- RS485/RS232 converter with SUB25/9 pin adapter
- Remote controller (7043D) including plastic part for panel mount
- AC power supply

Technical data:

RS485/RS232 converter	programmed for half duplex mode, 9600 baud
Remote controller	16 channel open collector output, non isolated
max load current	100 mA
max load voltage	+30 V
power input	+10 to +30 V
power consumption	1.1 W
Power supply	
input	100 to 240 VAC
output	24 V DC, 0.6 A

Note: By using the delivered power supply for the digital output line the maximum current for the 16 channels is 0.4 A.

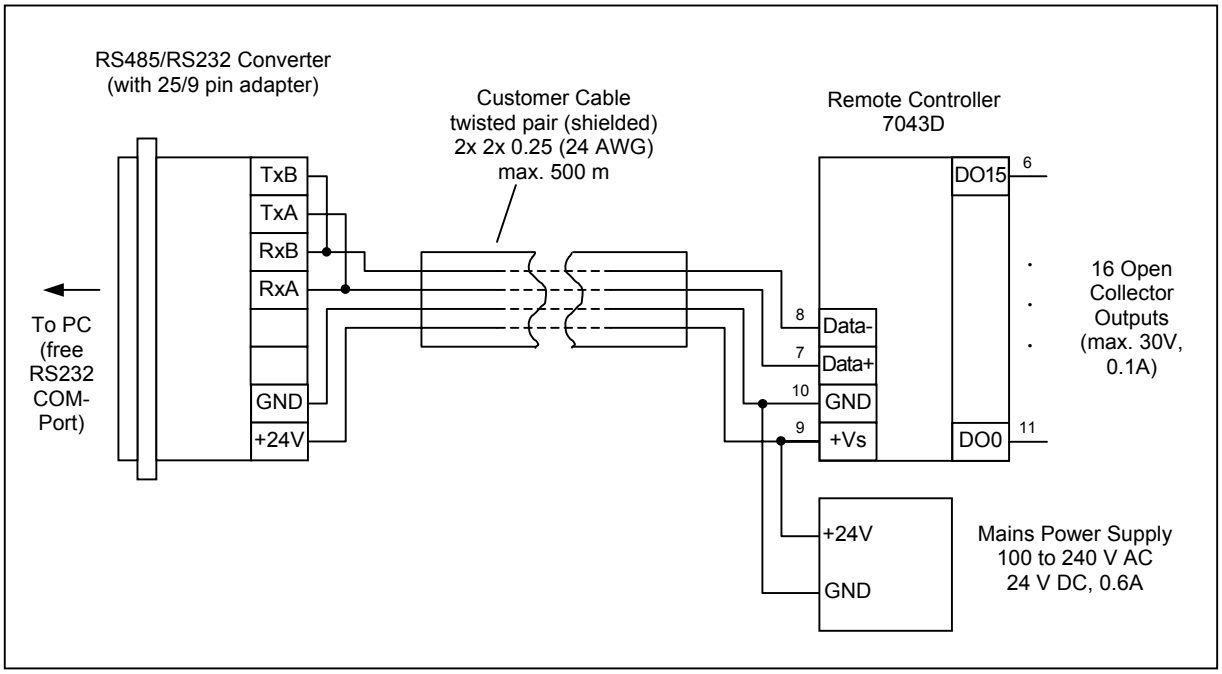


Figure 46: Wiring for Fan Control

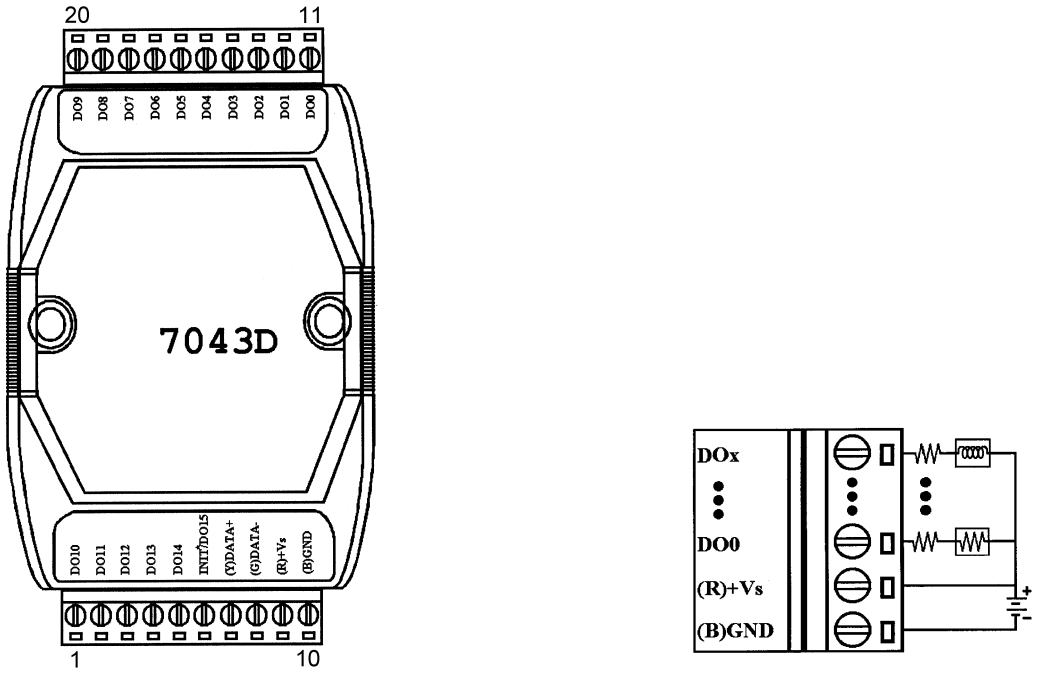


Figure 47: Pin Assignment (left), Wire connection for 7043D (right)

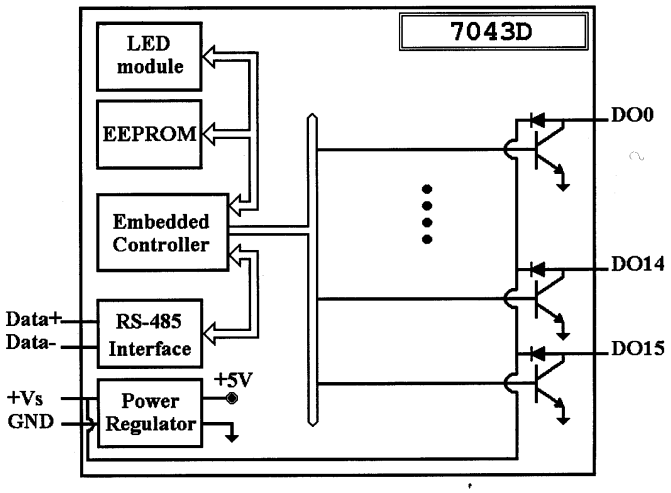


Figure 48: Block Diagram

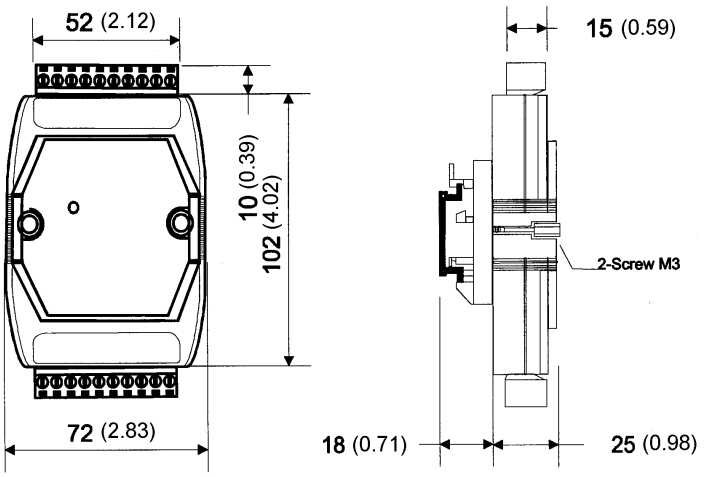


Figure 49: Dimensions

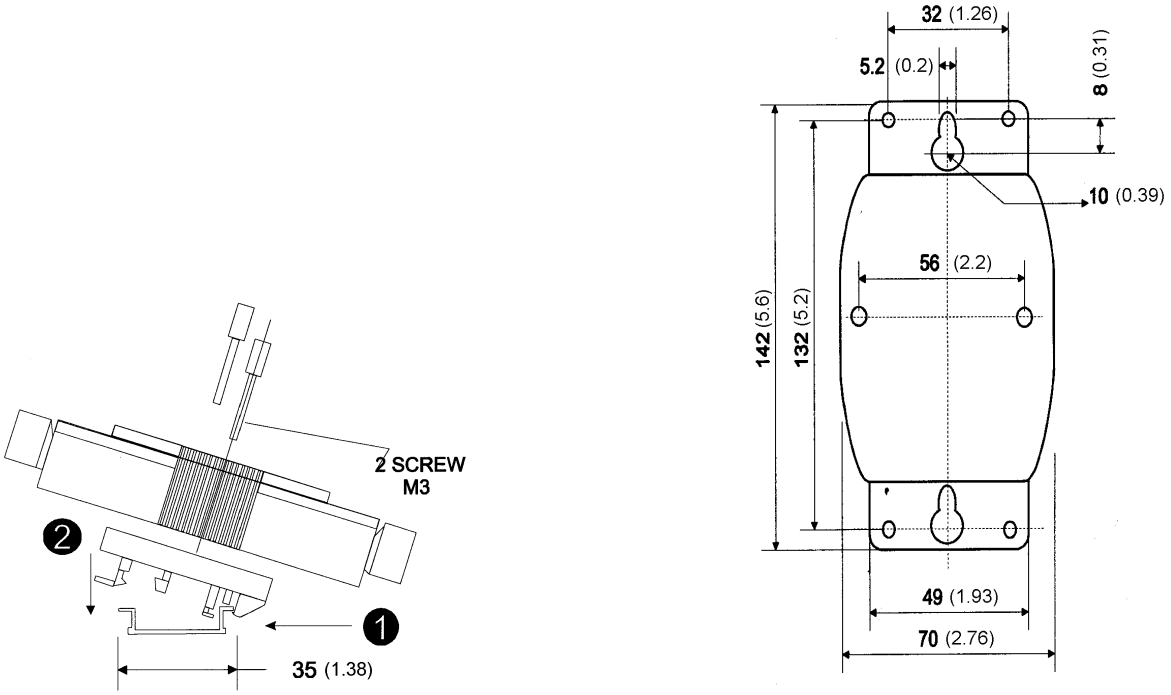


Figure 50: DIN-Rail Mounting (left), Plastic Part (right) for Panel Mount (included in the delivery)

7.3 LRM

7.3.1 Introduction

In order to avoid kiln deformations that can damage refractory during kiln startup and normal operation, kiln racking must be kept within certain limits. The kiln shell's racking is greatly affected by the degree of clearance between the tires and the kiln shell. The simplest and most accurate procedure is to measure the kiln shell's period of rotation in relation to the tires rotation. The result is termed as tire slip. The Live Ring Migration Monitoring System (LRM) is an automatic and continuous computer-based measurement and registration system designed to monitor tire slip and alert the user when tire constriction occurs.

Minimum System Requirements for LRM option
To operate the LRM software, we recommend the following:

- Personal computer 200 MHz or better Pentium II™ class system
- 64 MB RAM
- Windows NT 4.0 (Service Pack 3 or better)
- At least 10 MB hard disk space available for program
- SVGA monitor–800 x 600 resolution with 64K colors (High Color - 16 bit)
- Video card with 4 MB VRAM

Note: The software operates on systems running Windows 95 or 98, but performance will be compromised and may not be reliable.

System Overview
The LRM accessory package includes the following:

- Position indicator (3 pieces)
- Remote control unit with protective housing
- Connection Unit with RS485-to-RS232 converter
- SUBD 25- to 9-pin adapter
- Windows® Software (CD-ROM) and Operator´s Guide

7.3.2 Functionality

The LRM system monitors tire slip by measuring the rotation period of the kiln shell and of each tire. The rotation time differences between the shell and each tire are converted to a radial slip (arc length) unit (mm or inches).

Example: T_s = Kiln shell rotation time (milliseconds)
$T_{t1, t2, or\ t3}$ = Rotation time of tire #1, #2, or #3 (milliseconds)

The tire slip (in milliseconds) $\Delta T_{1, 2, or\ 3}$, for each tire is:

$$\Delta T_{1, 2, or\ 3} = T_{t1, t2, or\ t3} - T_s$$

With D = kiln diameter (mm), the slip distance (in mm) for each tire (#1, #2, or #3) is given respectively by:

$$\text{Tire slip}_{1, 2, or\ 3} = \pi * D * T_{1, 2, or\ 3} / T_s$$

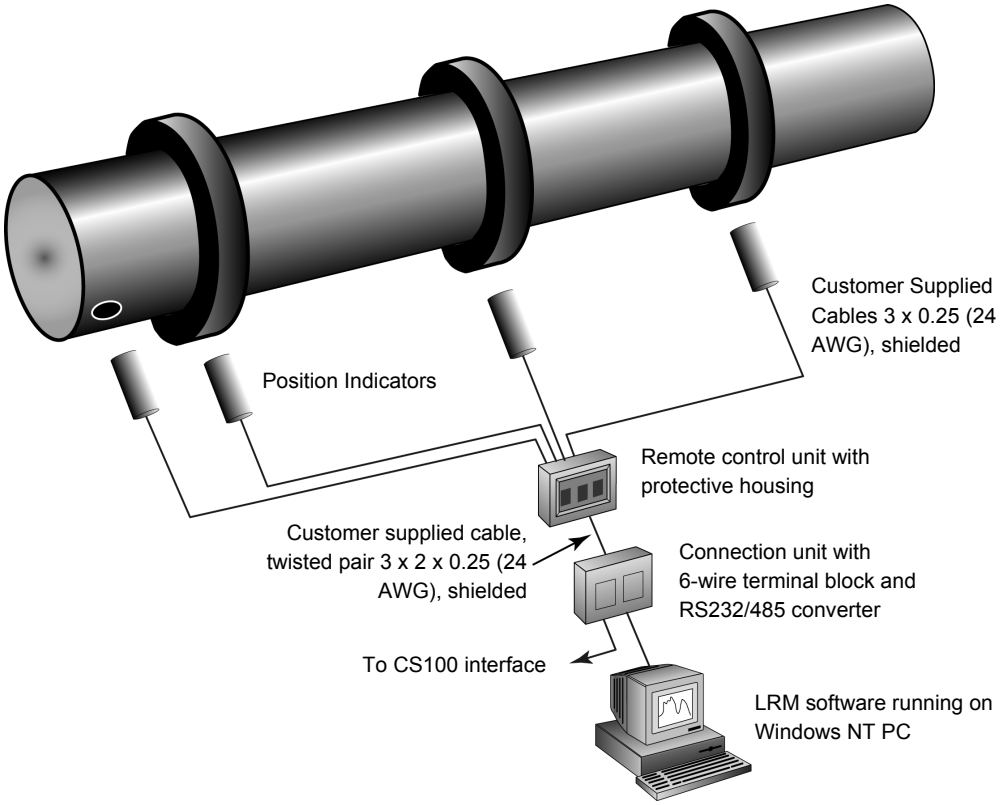


Figure 51: LRM System

7.3.3 Components

7.3.3.1 Position Indicator

Temperature resistant inductive proximity switches are used to trigger the PLC counter rotation time. These are placed at each tire.

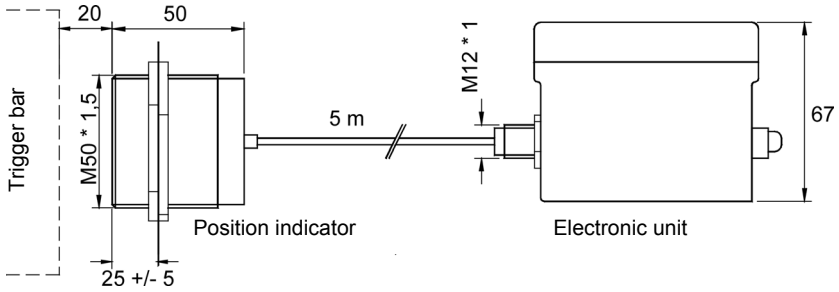


Figure 52: Position Indicator and Trigger Bar

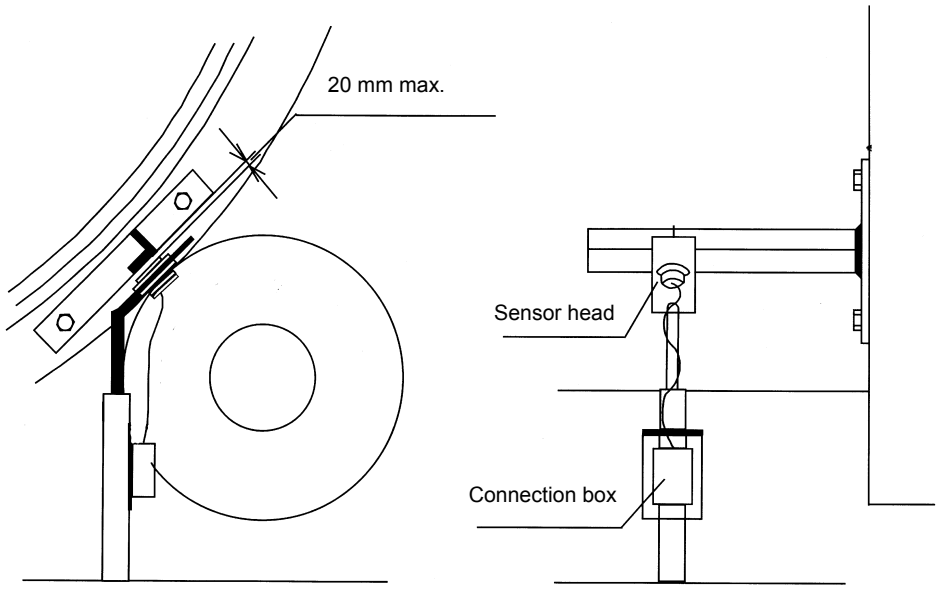


Figure 53: Mounting the Position Indicator

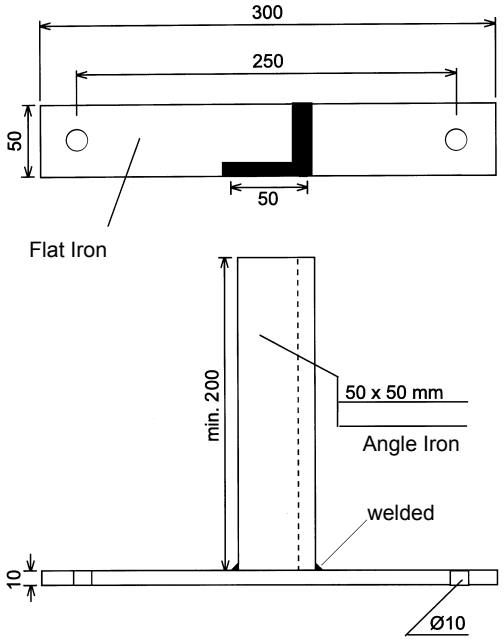


Figure 54: Trigger Bar -detail-

7.3.3.2 Remote Control Unit (LRM Timing Module)

The LRM timing module is comprised of a micro PLC and an RS-485 communication port, all in a protective enclosure. The controller's preprogrammed logic provides the time rotation counter. The related values of the kiln and the tires are then sent to the computer through the RS-485 port.

7.3.3.3 Connection Unit

The connection unit links the remote control unit and the CS100 interface to the PC. It includes a 6-wire terminal block and an RS485-to-RS232 converter with a 25- pin connector.

7.3.4 Wiring

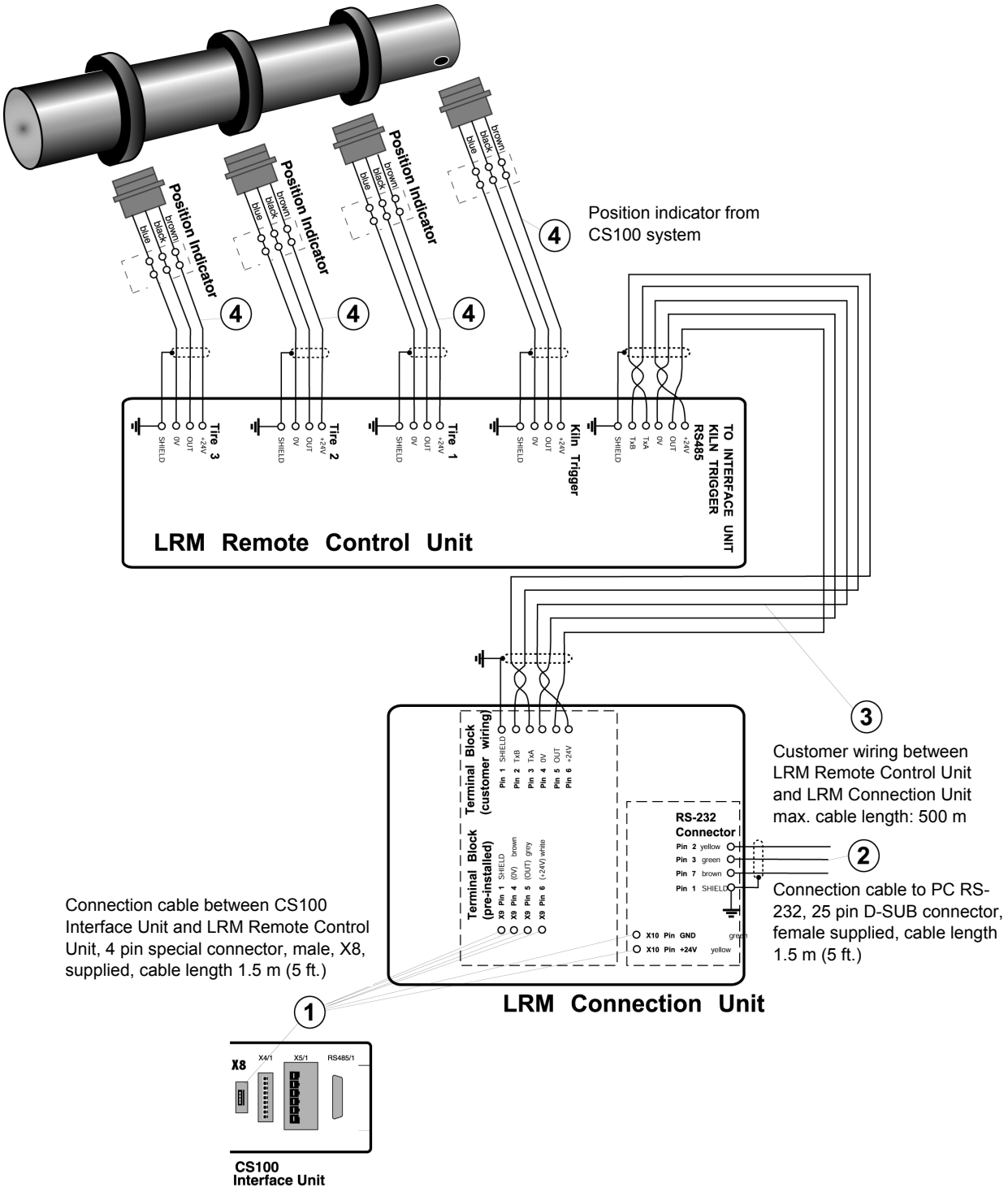


Figure 55: Wiring the LRM System

1) Connection CS100 Interface Box (X8) with LRM Connection Unit (pre-installed):

1.5 m shielded cable 3 x 2 x 0.25 mm2 (AWG24):

Wire:	From:	To:
	Interface Box	**Connection Unit**
Brown	CS100 (X8) Pin 1 (0 V)	LRM (X9) Pin 4
White	CS100 (X8) Pin 2 (24 V)	LRM (X9) Pin 6
Grey	CS100 (X8) Pin 3 (OUT)	LRM (X9) Pin 5
Shield	CS100 (X8) Pin 4	LRM (X9) Pin 1
Green	CS100 (X8) Pin 1 (0 V)	LRM (X10) Pin GND
Yellow	CS100 (X8) Pin 2 (24 V)	LRM (X10) Pin 24 V

2) Connection PC RS232 (SUBD25) with RS232 output from LRM Connection Unit (pre-installed):

1.5 m shielded cable 3 x 0.25 mm2 (AWG24):

Wire:	From:	To:
		Connection Unit
Yellow	PC SUBD25 Pin 2	LRM SUBD232 Pin 2
Green	PC SUBD25 Pin 3	LRM SUBD232 Pin 3
Brown	PC SUBD25 Pin 7	LRM SUBD232 Pin 7

3) Customer wiring between LRM Remote Control Unit and LRM Connection Unit:

Shielded cable 3 x 2 x 0.25 mm2 (AWG24), max. 500 m:

Wire:	From:	To:
		Connection Unit
(Shield)	Remote control unit (Shield)	LRM (X9) Pin 1
1 of pair 1	Remote control unit (TxB)	LRM (X9) Pin 2
2 of pair1	Remote control unit (TxA)	LRM (X9) Pin 3
1 of pair 2	Remote control unit (0 V)	LRM (X9) Pin 4
1 of pair3	Remote control unit (OUT)	LRM (X9) Pin 5
2 of pair 2	Remote control unit (+24 V)	LRM (X9) Pin 6

4) Customer wiring between position encoder and LRM Remote Control Unit:

Shielded cable 3 x 0.25 mm2 (AWG24), max. 200 m:

Wire:	From:	To:
1	Position encoder wire brown	Remote control unit +24 V
2	Position encoder wire blue	Remote control unit 0 V
3	Position encoder wire black	Remote control unit OUT
Shield	Cable gland insert	Remote control unit Shield

7.3.5 Software

The software consists of the following features:

- Real-time tire slip measurement (in mm or inches) and rotation per minute indication (RPM)
- Trend and historical profiles with zoom and graph rescaling
- High and low alarms

- Alarm logging
- Kiln number of tire and diameter setup
- Quick and easy printing to document quality conformance
- Supports 1 to 6 tires

7.3.5.1 Installation

Important
You should exit all Windows applications and disable any virus programs and screen savers before installing the software.

To install the LRM system software, complete the following steps:

1. Insert the CS100 CD into the CD-ROM drive.
2. Click on the Start button then select Run. Type D:\rayturn\install and click OK. The Installation Wizard starts.
3. Follow the on-screen directions to complete the installation.

7.3.5.2 Operation

The LRM program follows standard Windows conventions. The following sections were written with the assumption that you are familiar with the Windows Operating system environment. If you need help using Windows, refer to the manual that came with your Windows software.

To start the LRM system program, do the following:

1. Click the Start button.
2. Select Programs, then Raytek, and "LRM". After the program starts, you will see a blank gray screen with a menu bar across the top. The following sections describe menu bar choices and how to begin operating the software.

Along the top of the main screen is the menu bar. It is comprised of standard Windows drop-down menus including File, Loop, View, Window, and Help.

7.3.5.3 The File Menu

The File Menu has two selections: Configuration and Printer Configuration.

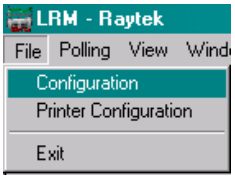


Figure 56: The File Menu

The first time you run the program you need to configure the software to monitor your particular kiln shell. When you select Configuration, a screen similar to the following displays. Explanations of each feature follow on the next page.

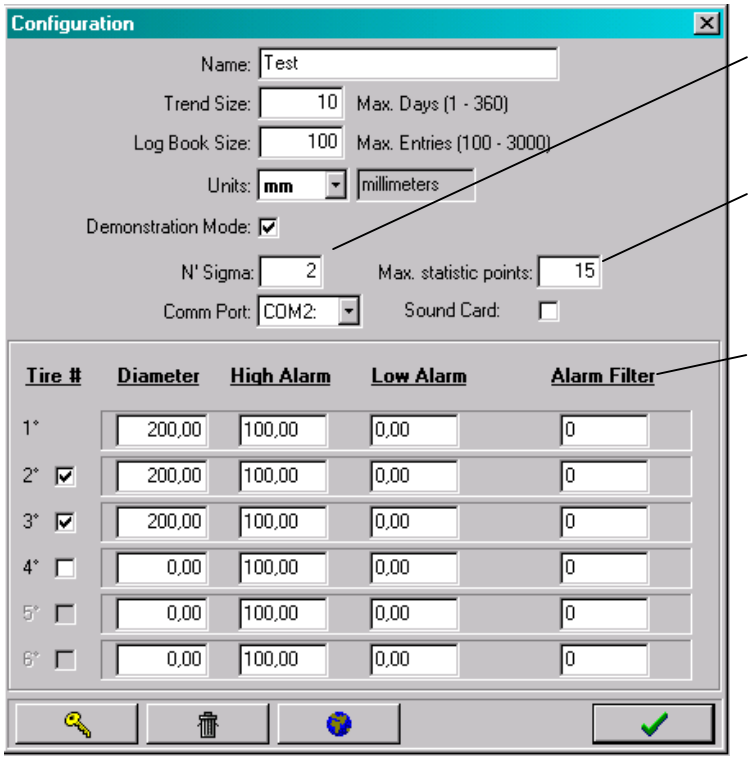


Figure 57: The Configuration Screen

The system configuration defines its behavior during its execution. The top set of fields are related to the following functions:

Name – You can give the monitored shell a unique name here that will be printed in the reports.

Trend size – The number of days that the system will maintain the data stored. This file is a rotative file, which means it will store the last N days of information. The trend can be set to log from 1 to 360 days.

Log Book size – The number of entries (events, such as a high alarm) stored in the file. The file is rotative.

Units – Select metric or standard units of measure. All displayed and printed data will be based on the selection.

Demonstration Mode – This informs the system if random values or real data will be used in its execution.

- Max.: maximum value of random slopes
- Min.: minimum value of random slopes

Shell Diameter – The shell diameter is used to calculate rotation.

Comm Port – Communication port through which the control equipment is connected.

Sound Card – Indicates if the system should emit a sound in an alarm situation. This option is only available if the personal computer is equipped with a sound card, otherwise a beep sound will be emitted. The sound file „ERROR.WAV.“ is located in the Installation directory and it may be changed if the recording time limit of 2 seconds is regarded. The bottom half of the Configuration window is a table where you can setup the high and low alarms for each monitored tire.

High Alarm – Enter the maximum allowable tire dislocation (in the appropriate unit of measure) in relation to the shell to activate the high alarm.

Low Alarm – Enter the minimum allowable tire dislocation (in the appropriate unit of measure) in relation to the shell to activate the low alarm.

Alarm Filter – At the bottom of the window are three buttons that show a key, a garbage can, and a check mark.

Key Button – To password protect the configuration data, click on the Key Button and enter a password.

Garbage Can Button – Click on the Garbage Can Button to clear the data from the Configuration window.

Check Mark Button – Click this button to exit the Configuration window.

7.3.5.4 The Loop Menu

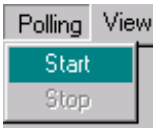


Figure 58: The Polling Menu

The Polling Menu has two selections: Start and Stop.
Start – Starts data logging.
Stop – Stops data logging.

7.3.5.5 The View Menu

The View Menu allows to select: Trend, History, Kiln View, Log Book, and Bar Graph.

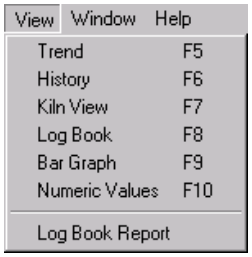


Figure 59: The View Menu

Trend – The Trend Graph window displays values in real-time. Because the Trend Graph is a window, you can minimize and maximize it and size it by putting the mouse cursor on and edge or corner of the window, holding down the left mouse button, and dragging the edge or corner to set the window for best viewing convenience. You can move the window to other positions on the screen by putting the mouse cursor on the top bar, holding down the left mouse button, and dragging the window.

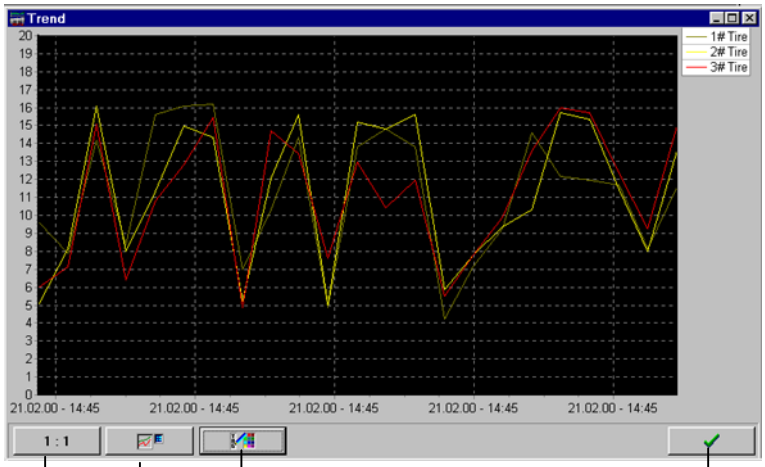


Figure 60: Trend Graph Window

•Exit Window Button
Click on this button (shown with the check mark) to exit the Trend Graph window.

•Trend Graph Configuration Button
Click on this button to display the configuration window

•View Legend Button
The legend that shows the different tire ring plot colors can be displayed or not displayed.

•1:1 Scale Button
To return to the initial scale press the 1:1 button.
Note that automatic updating will only be performed at 1:1 scale.

In the **Trend Graph configuration window** you can select the color for each tire ring to use, indicate the maximum value for the graph scale, indicate the minimum value for the graph scale, and select the graph's background color.

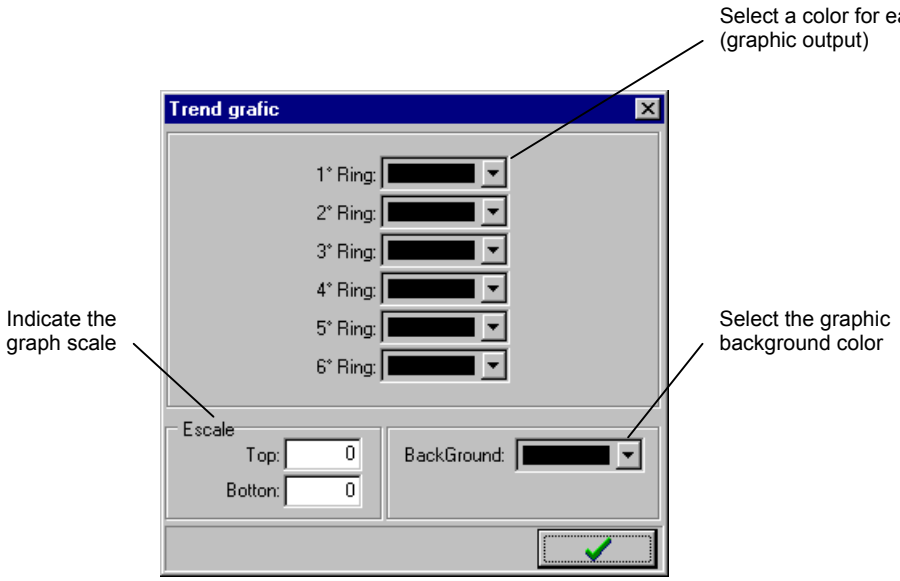
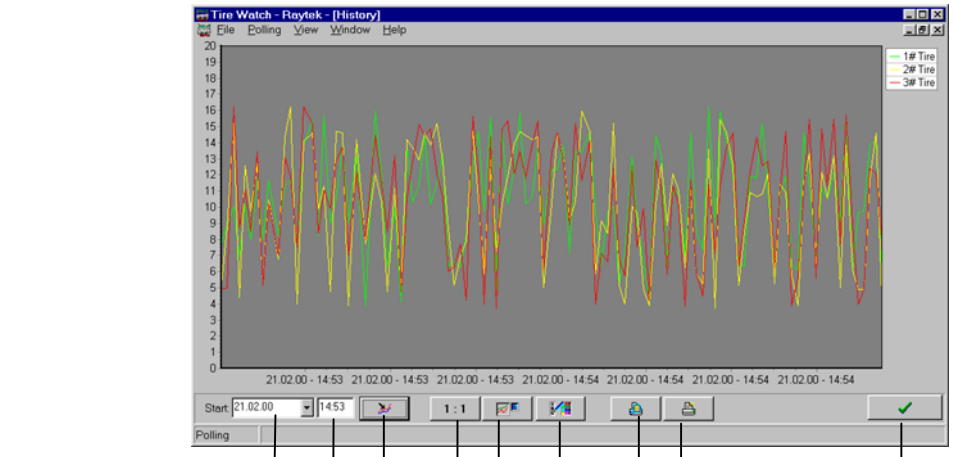


Figure 61: Trend Graph Configuration Dialog

You can also display the Trend Graph Window by pressing the F5 key.

History – The History Graph window gives you a visual representation of the current log. Date and time are shown along the bottom of the chart. You can view and/or print the log data from this window. The maximum capacity for graphic record display is 10,000 plots registered simultaneously. Because the History Graph is a window, you can minimize and maximize it and size it by putting the mouse cursor on and edge or corner of the window, holding down the left mouse button, and dragging the edge or corner to set the window for best viewing convenience. You can move the window to other positions on the screen by putting the mouse cursor on the top bar, holding down the left mouse button, and dragging the window.

Figure 62: The History Graph Window



•Date Menu
Click on the down arrow to display a calendar. Pick a date for your start record.

•Time Entry
Enter a start time

•1:1 Display Graph
Creates a visual display for the time period you set. Click the button again to clear the screen.

•1:1 Scale
To return to the initial scale press the 1:1 button.
Note that automatic updating will only be performed at 1:1 scale.

•View Legend
The legend that shows the different tire ring plot colors can be displayed or not displayed

•History Graph Configuration

•Print Preview

•Print

•Exit History Graph

In the **History Graph configuration window** you can select the color for each tire ring to use, indicate the maximum value for the graph scale, indicate the minimum value for the graph scale, and select the graph's background color.

The **Print Preview window** has a series of icons across the top that allow different viewing, printing, and saving methods. You can view full size, fit to width of window, or display full page. The arrow icons allow you to navigate through the pages. The printer icons are for printer setup and print. The diskette icon is for saving the files, and the folder icon is for opening files. To exit the Print Preview window, click on the Close button.

You can also display the History Graph Window by pressing the F6 key.

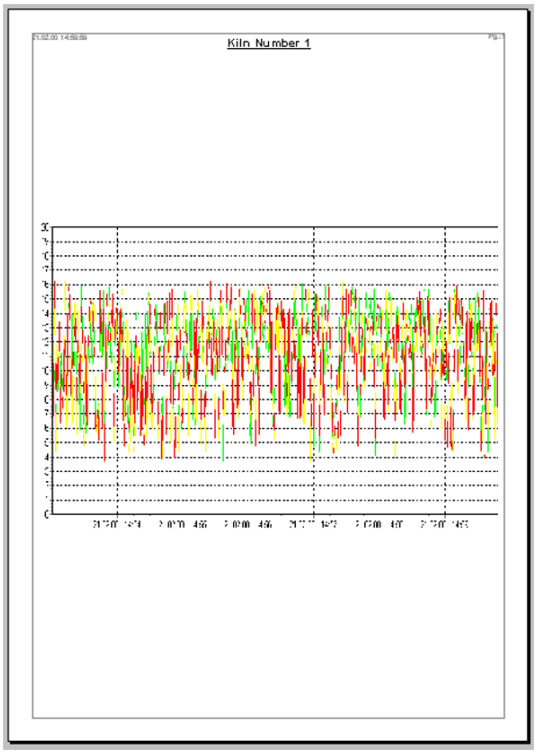


Figure 63: Print Preview Window

Kiln View – When you select Kiln View from the View menu a screen similar to following displays. This window gives you a real-time visual display of the kiln shell and the number of tires you are monitoring. The numbers show the amount of migration that is occurring. To exit this window, click on the button with the check icon.

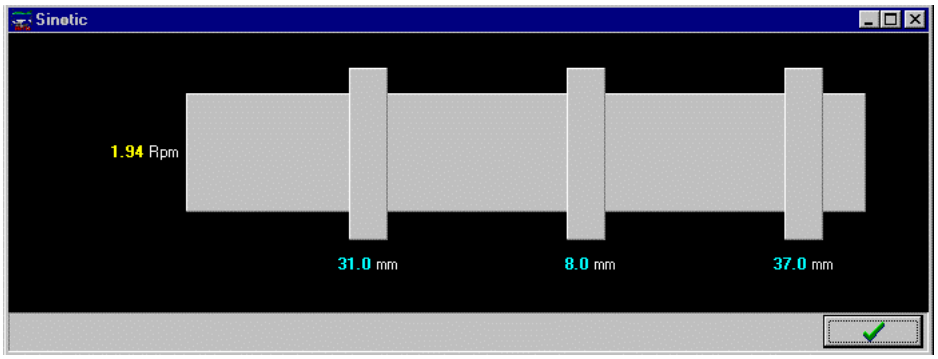


Figure 64: Kiln View Window

Log Book – Selecting Log Book from the View menu displays a screen similar to the following. This allows you to view real-time data logging. The Log Book stores information relating to the following:

- System entries and exits
- Registration starts and stops
- Alarm entries
- Alarm recognition

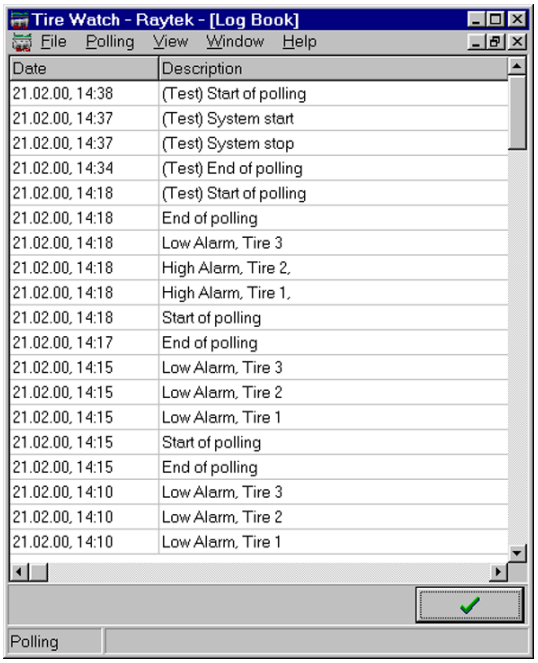


Figure 65: Log Book Window

Bar Graph – Selecting Bar Graph from the View menu gives a screen similar to the following. The screen will be automatically updated.

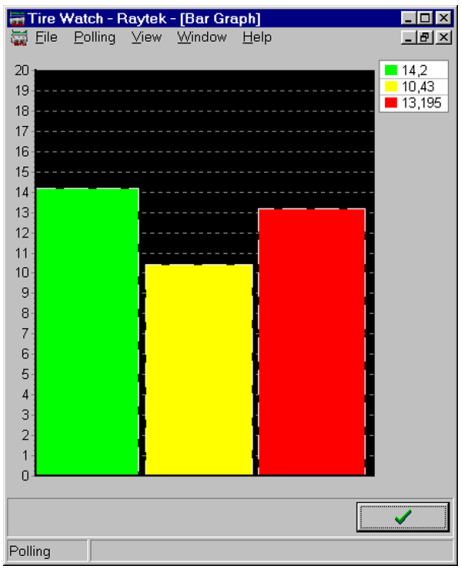


Figure 66: Bar Graph Window

LogBook Report – Use this feature to view and/or print the Log Book. If you click on the down arrow, a calendar displays where you can pick a starting date for the report. Next to the date is a time field where you can also enter a start time. Across the bottom of the window are three buttons where you can select exit, Print Preview, or Print.

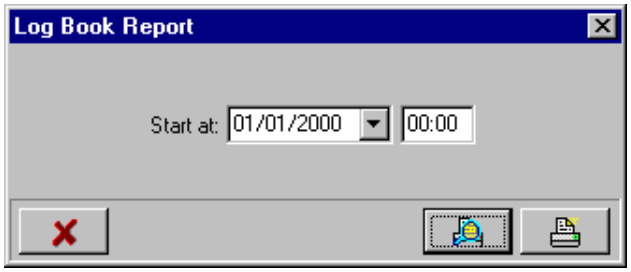


Figure 67: Log Book Report Setup Window

7.4 Fiber Optic Installation Kit

The installation according to section 8.11 Two Scanner Installation with Fiber Optics on page 71 represents an optional fiber-optic installation using the optional Fiber Optic Installation Kit. Fiber optic transmission provides protection against a variety of adverse effects that otherwise cause problems with transmission of data over copper cable. Such problems include the immunity that fiber optic data transmission has to: Electromagnetic Interference (EMI), lightning-induced current surges, and ground loops. The Fiber Optic option is recommended for sites subject to:

- Frequent electrical storms and lightning-induced surges.
- Electrical power interruptions, surges, and other electrical disturbances.
- Large voltage differences between the scanner stands and the control room.
- Manufacturing environments with harsh electrical interference (EMI) conditions.

The Fiber Optic Installation Kit includes:

1. Two identical pieces of four-COM-channel fiber-optic multiplexers (FOX). The FOX (size: 11 x 5 x 2 cm / 4.3 x 2 x 0.8 in) will transport four full duplex channels of asynchronous RS232 data over two fiber optic cables. FOX units are available in 110 / 230 VAC versions.
2. Two pieces: RS232 cable loop with four connectors (RJ11)
3. Eight pieces: special connector RJ11 to 25 pin Sub-D

Fiber Optic Cable Specification

The fiber optic cables, which connect the two FOX units, must be provided by the customer according to the following specification:

Quantity:	2 single-core cables or 1 double-core cable
Length:	Specified by customer as required, max. 4 km (2.5 miles)
Optical connector style:	ST
Cable recommendation:	core diameter = 62.5 microns cladding diameter = 125 microns OFNR (UL) OFN FT4 (CSA)
Suggested manufacturer/type:	Corning, 62.5/125 multimode.

The primary difference in the fiber-optic installation configuration compared to that of copper cabling is that two fiber-optic cables and two fiber-optic multiplexer (FOX) units have replaced the copper cables of the RS232 communication between interface box and PC. Otherwise, the installation is electrically identical.

Note: The correct wiring of the fiber optic cables is indicated by a permanent light of the SYNCHRON LED on the front panel of the multiplexer.

Attention: All DIP switches of the module must be set to "Off"!

Protected Area

Note that several system components (a FOX unit, Interface Box, Connection Box) must be housed in a protected area that is closed or otherwise shielded from elements of weather and direct sunlight. This protected area could be an office, lab, warehouse, or instrument "shed".

The criteria for the protected area are that its ambient environment be controlled within the temperature range 0 - 50°C (32 - 122 °F), have relative humidity 5 - 95% (non-condensing), and have suitable AC-mains power available locally.

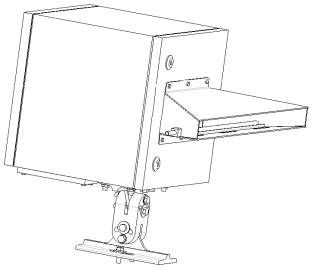
8. Appendix

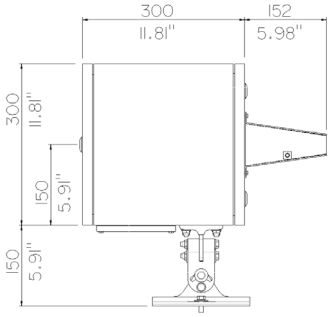
8.1 Spare Parts for CS100 System

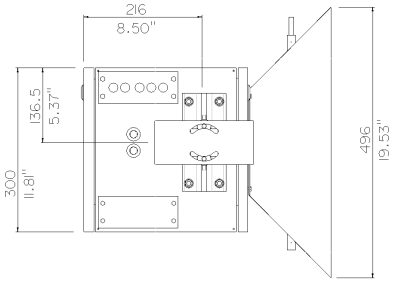
Part No.	Description
XXXSYSPHSS	Stainless Steel Protective Housing
XXXSYSCS100IF	Interface Box (software license is necessary)
XXXSYSECPI	Position Encoder
XXXSYSCON	Connection Box
XXXSYSCONGP	Cable Grommet Plate with grommets for SYSPHSS or SYSCON
XXXSYSPHSW	Protective Window for SYSPHSS

Note: For ordering parts please contact the local agent or the Raytek Service Department.

8.2 Protective Housing







Part No.	Description
XXXSYSPHSS	Protective Housing for using a linescanner outdoor or in rugged industrial ambient. Includes: - stainless steel box - galvanized adjustable mounting bracket allowing aiming along any axis - air purge - all mounting parts - grommets and grommet plate

Technical Data:

Material

Box	Stainless Steel 1.4301
Seal	EPDM, CR
Mounting Bracket	galvanized steel
Dimensions (h x w x d)	300 x 300 x 300 mm (11.81 x 11.81 x 11.81 inches)
- with mounting frame	height is about 450 mm (17.72 inches)
Weight	about 20 kg (44lbs) (linescanner included)
Protection class	IP 54
Window transmission	0.9

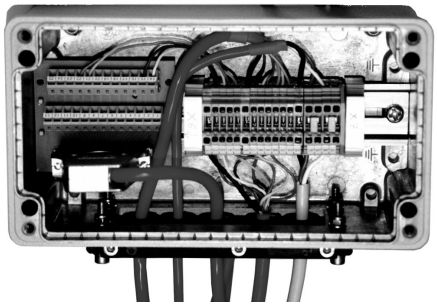
Air purge

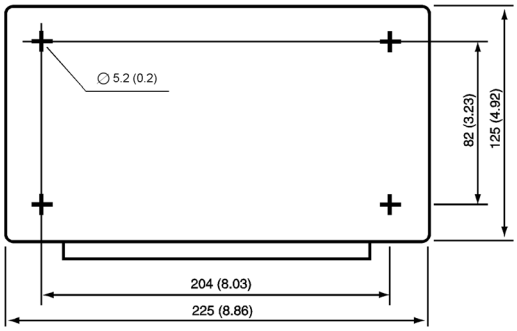
Connector	outer diameter 8 mm (0.315)
Pressure	1.5 to 3 bar (air must be cleaned)

Scope of delivery: stainless steel box with removable window
Quick-release rail mounted scanning system
adjustable mounting bracket
spare removable window

Options: air – water heat exchanger

8.3 Connection Box





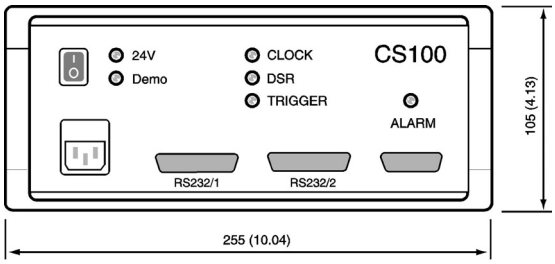
Part No.	Description
XXXSYSCON	Connection Box - connect the linescanner high temperature cable with the customer cable - enclosure is made of aluminum die-cast according to EMC - cable grommet plate to insert the cable - the linescanner communication cable keep the Sub-D-connector. A laptop can be connected to adjust or check the linescanner. - quick installation line-up terminals

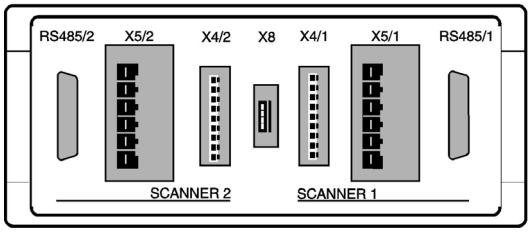
Technical Data:

Material	
Box	Aluminum die cast
Cable Grommet Plate	Polyamide, halogen free and thermoplastic rubber
Temperature Range	-40 to +80°C (-40°F to 168°F)
Dimensions (h x w x d)	90 x 225 x 130 mm
Weight	1.8 kg

Scope of delivery: connection box
cable grommet plate
line-up terminals and Sub-D connector
set of grommets for different cable sizes

8.4 Interface Box





Part No.	**Description**
XXXSYSCS100IF	- interface to synchronize the program CS100 and the rotary kiln - useable for CS101 (one linescanner) and CS102 (two linescanners) - includes two adapters RS485/RS232 - includes power supply for two linescanners - with buzzer for scanner and alarm relay output - all connectors are included

Technical Data:

Material	
Box	Aluminum
Temperature Range	0 to + 40°C (32°F to 104°F)
Dimensions (h x w x d)	115 x 257 x 256 mm
Weight	1.3 kg (2.9 lbs)
Voltage Range	85 to 264 VAC, 50 to 60 Hz
Alarm Relay Output	30 V / 1 A, free of potential
Scope of delivery:	interface box connection cables to the computer connectors power supply cable

8.5 Interface Box Settings

Demo Mode, switch S3: (without position indicator)

Number of lines per revolution:	100 (not changeable)
Time setting for one revolution:	S2 (minutes) S1 (tenth of a minute)
Example:	S2 = 0 and S1 = 5 sets the time to 30 s

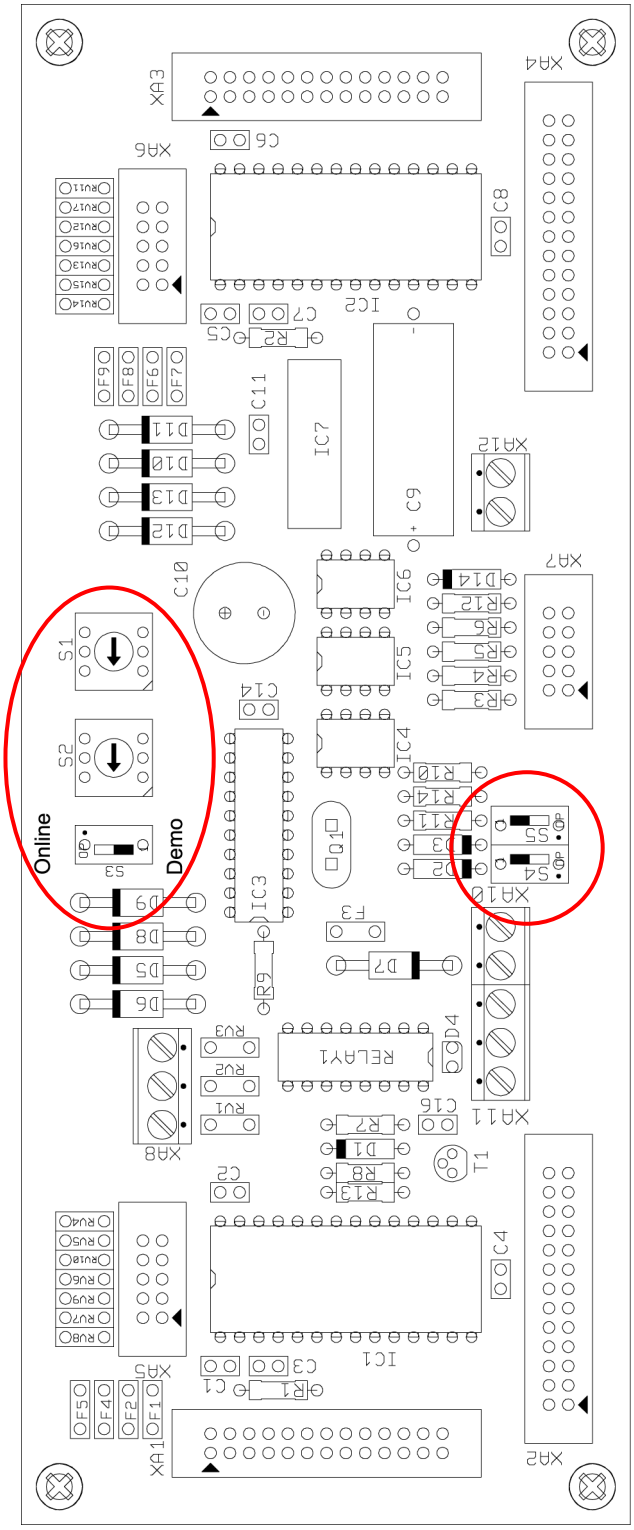
Online Mode, switch S3: (with position indicator)

Line count:	should be always set to 100, adjustable with S2, S1
Examples:	S2 = 0, S1 = 0 (number of lines = 100)

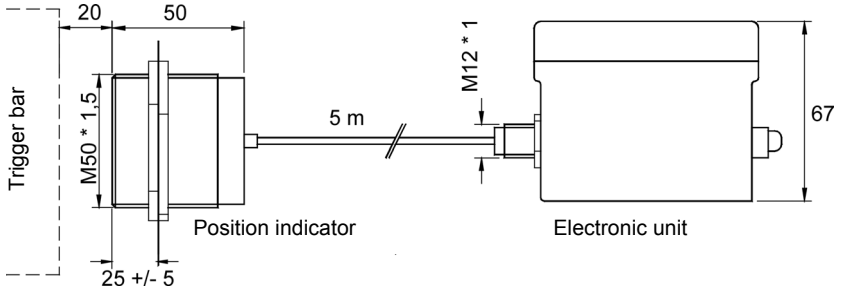
Note: S4 and S5 have to be set to "OFF"!

The locations of the switches are to be found on the interface board, see section 8.6 on page 66.

8.6 Interface Board



8.7 Position Indicator



Part No.	Description
XXXSYSECPI	Proximity switch for synchronizing process and program - tough design - high switch distance - temperature range sensor head: - 25 to 230°C (- 13 to 446°F) - simple mounting with mounting plate - separate electronic with connection box

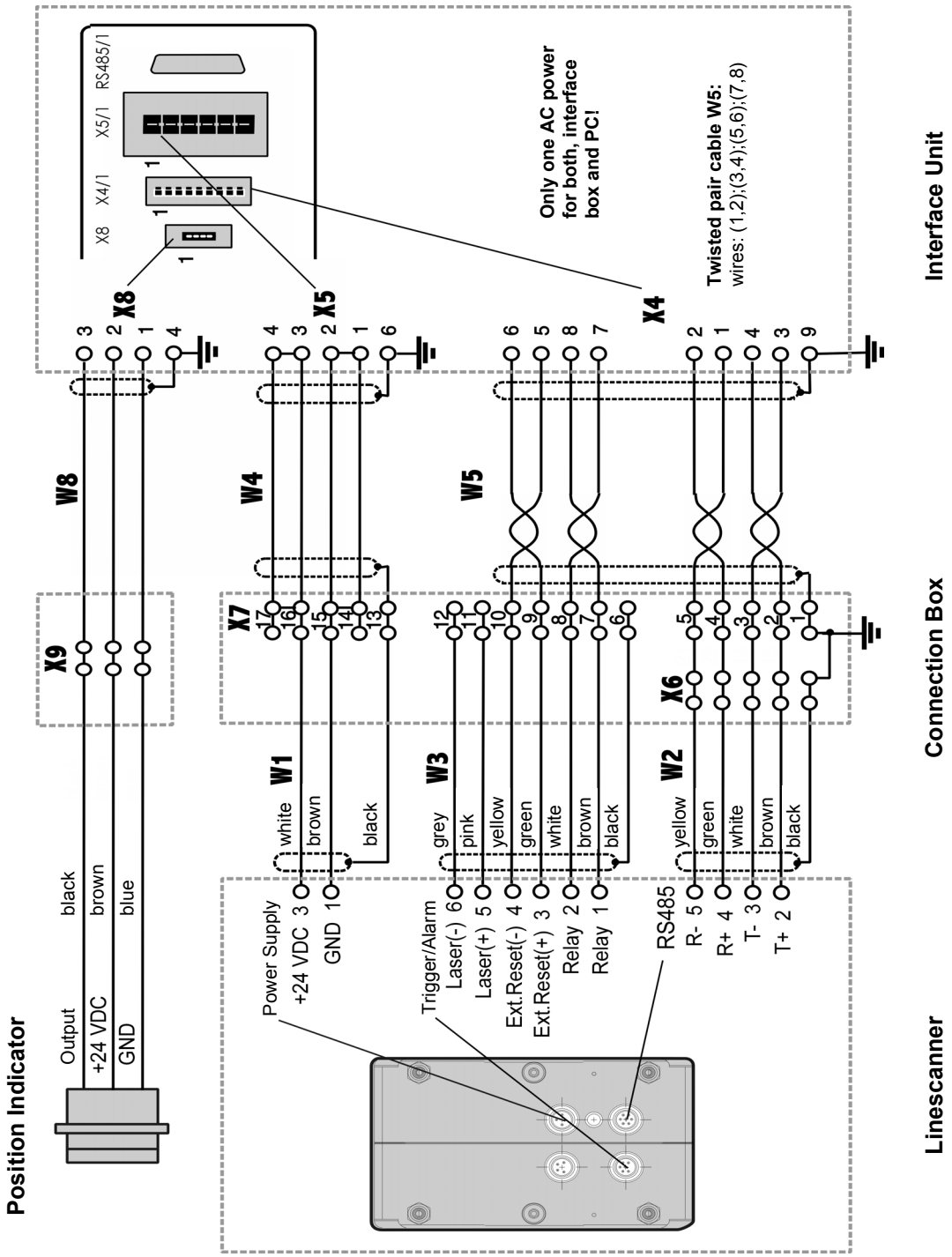
Technical Data:

Switching distance	20 mm (0.79 inches) (positioned to steel St37 , sized 50 mm in square (2.16 in. in square))	
Temperature range		
sensor head:	25 to 230°C (- 13 to 446°F)	
electr. module:	25 to 70°C (- 13 to 158°F)	
Output	No. 2: active 24 V / 300 mA max. short circuit protected	
Connector pins	X8-Pin 2 (brown cable): X8-Pin 3 (black cable): X8-Pin 1 (blue cable):	+ 24 VDC (7 to 40 VDC), ripple max. 15 % output active 0 V

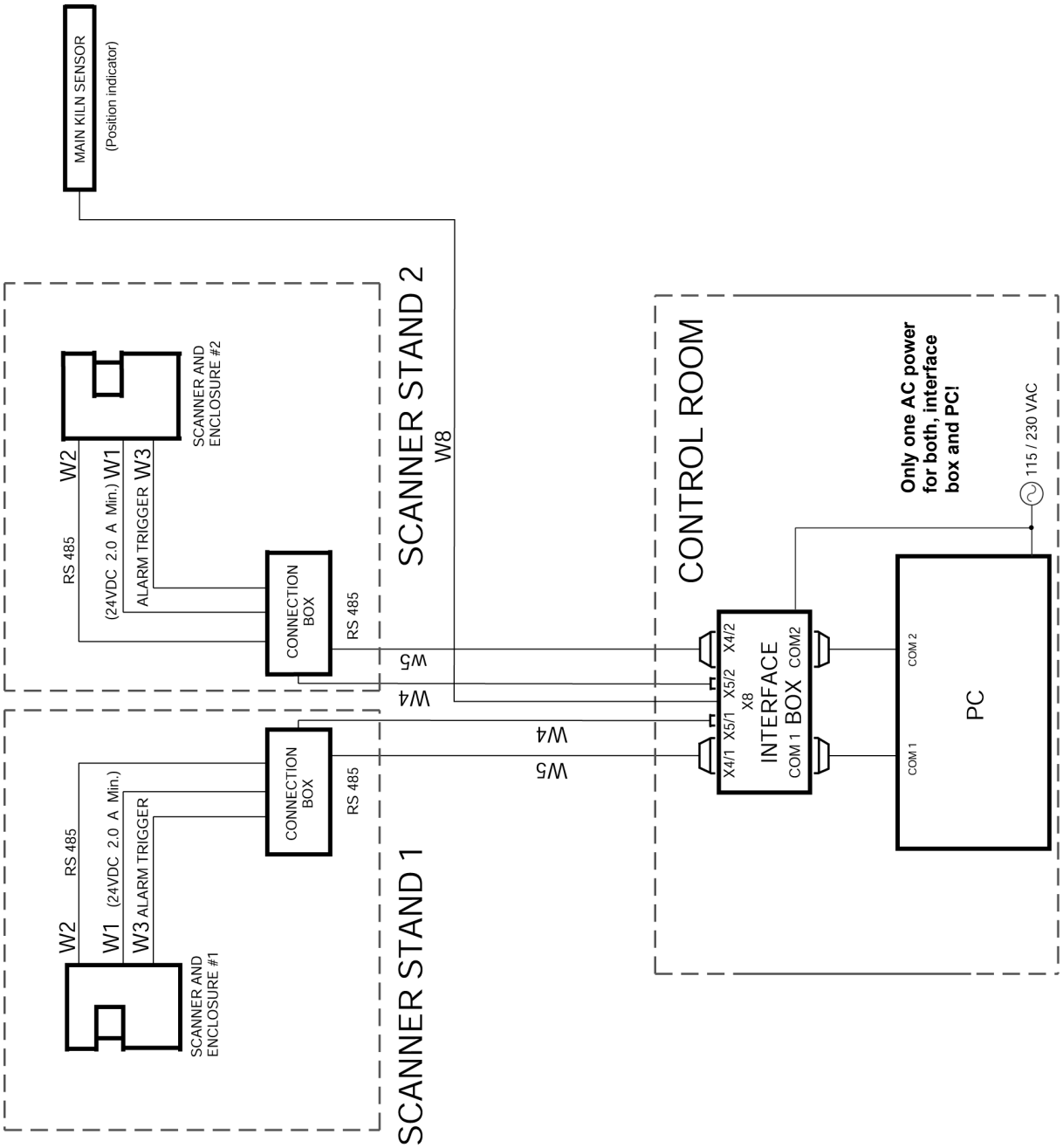
Dimensions

sensor head:	50 mm (1.97 inches) dia, length 55 mm (2.17 inches)
Mounting requirements	
sensor to sensor	min. 50 mm (1.97 inches)
sensor to metal	min. 15 mm (0.6 inches)
Protection class	IP67
Length of cable	5 m (15 feet)

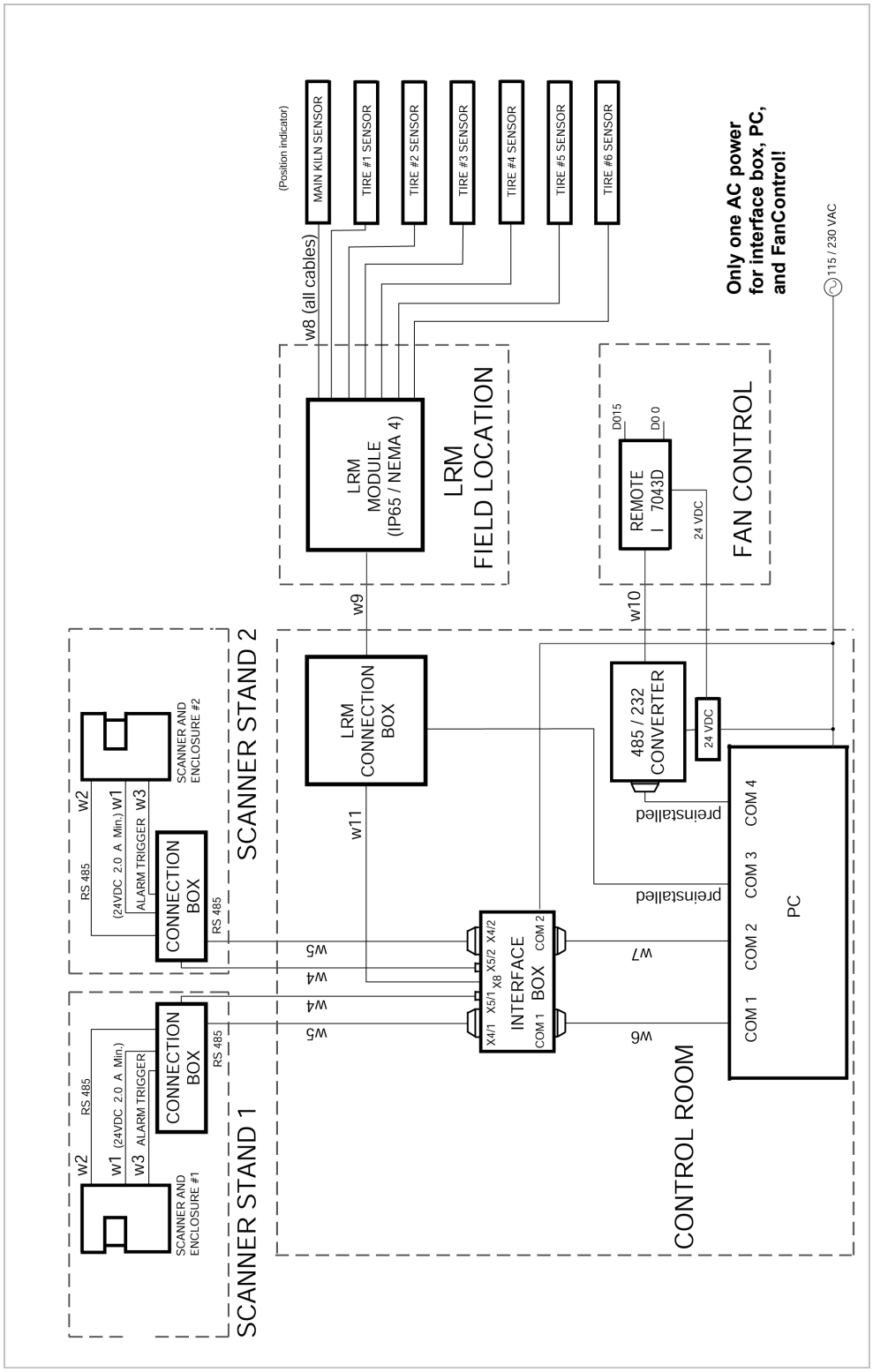
8.8 One Scanner Standard Installation



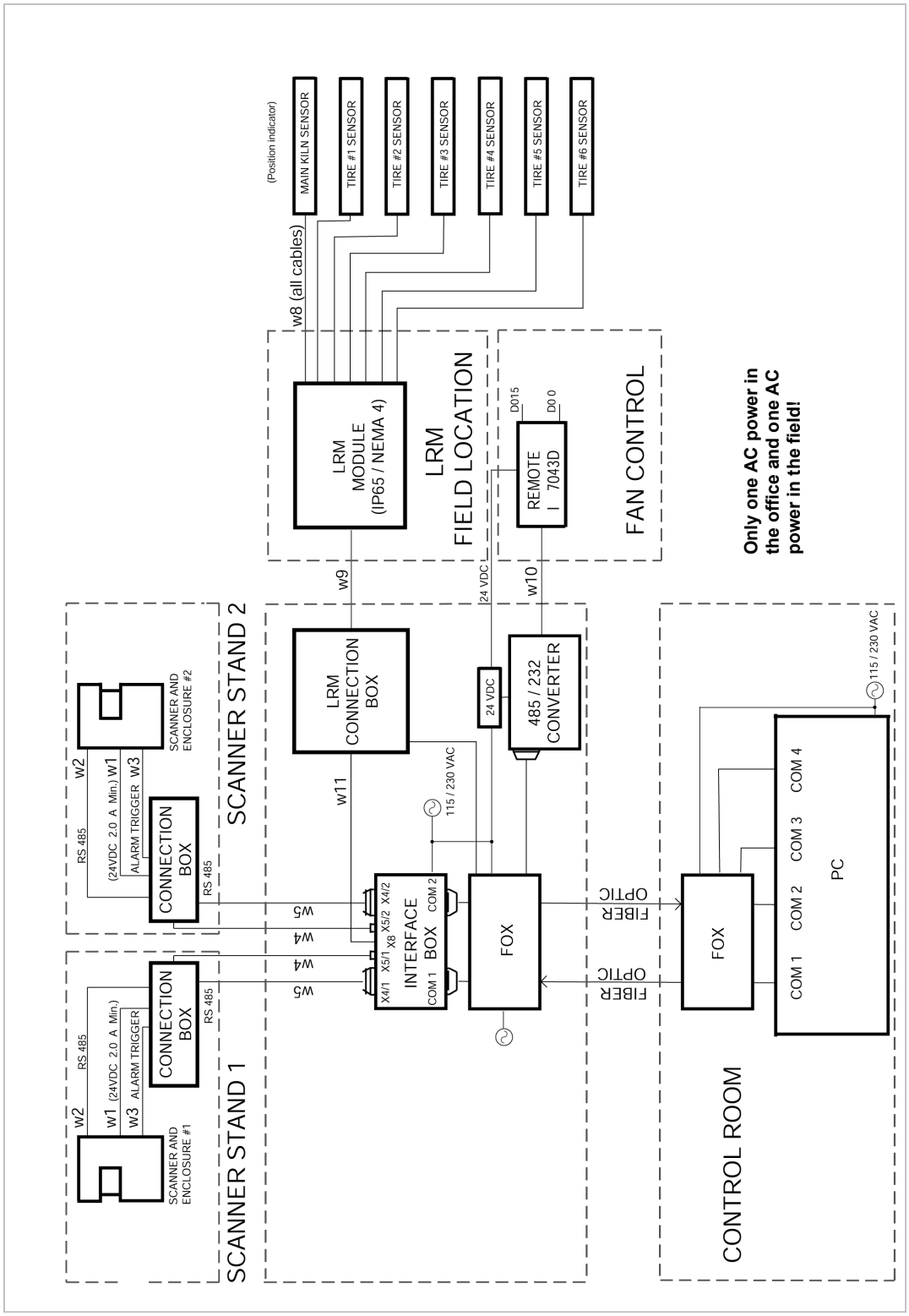
8.9 Two Scanner Installation



8.10 Two Scanner Installation with LRM and Fan Control



8.11 Two Scanner Installation with Fiber Optics



Note: For additional information see section 7.4 Fiber Optic Installation Kit on page 61.

9. Index