Heraeus

Instruction and Operating Manual

Oxygen and Temperature Measuring Unit

Multi-Lab Celox

V 2.14

Date of issue: 15.01.2001

Electro-Nite

Heraeus

Safety-Related Guidelines For the User

for mains-operated devices

Date of issue: 28.02.1998

Electro-Nite

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1 Safety Instructions

Warning : This device is a Safety Class I product and must be connected to an earth conductor. If the device is operated without an earth conductor, there is serious danger!

- ☐ Only use fuses conforming to specification with correct current rating and suitable voltage range and response behaviour. Never use repaired fuses or fuse inserts short-circuited with a wire. The use of bridging arrangements of this kind can result in current surges, generation of sparks and risk of fire.
- ☐ Equipment covers must not be opened by operating personnel. Maintenance and repair work may only be carried out by qualified service personnel.
- ☐ The device must not be operated in the proximity of inflammable gases or vapours. The operation of electrical equipment in a hazardous environment is extremely dangerous and can result in personal injury and damage to property.
- ☐ Do not carry out any unauthorised alterations to the device.

1.1 Earthing of the device

- ☐ The casing must be earthed before switching on the device. Therefore, a three-wire power cable with earth conductor must always be used when operating the device. The power cable may only be plugged into a power socket with earthed conductor. Do not cancel out the earthing effect by using an extension cable without earth conductor. Even two-wire power sockets in which one conductor has been earthed, will not give sufficient protection.
- ☐ If the device is being operated via a transformer, make sure that the casing is connected to protective earthing.
- ☐ If you have reason to assume that the protective earthing of the device is ineffective, the device must no longer be operated. The device is to be stored so that inadvertent switching on or operation by unauthorised personnel is not possible.

2 Safety Related Guidelines for the User

2.1 General

This manual provides the information required for the intended use of the particular product. The documentation is written for technically qualified personnel such as engineers, programmers or maintenance specialists who have been specially trained and who have the specialized knowledge required in the field of instrumentation and control.

A knowledge of the safety instructions and warnings contained in this manual and their appropriate application are prerequisites for safe installation and commissioning as well as safety in operation and maintenance of the product described. Only qualified personnel as defined in section 1.2 have the specialized knowledge that is necessary to correctly interpret the general guidelines relating to the safety instructions and warnings and implement them in each particular case.

This manual is an inherent part of the scope of supply even if, for logistic reasons, it has to be ordered separately. For the sake of clarity, not all details of all versions of the product are described in the documentation, nor can it cover all conceivable cases regarding installation, operation and maintenance. If you require further information or face special problems that have not been dealt with in sufficient detail in this documentation, please contact HERAEUS Electro-Nite.

We would also point out that the contents of this product documentation shall not become a part of or modify any prior or existing agreement, commitment or legal relationship. The Purchase Agreement contains the complete and exclusive obligations of HERAEUS Electro-Nite. Any statements contained in this documentation do not create new warranties or restrict the existing warranty.

2.2 Qualified Personnel

Persons who are **not qualified** should not be allowed to handle the equipment/system. Non-compliance with the warnings contained in this manual or appearing on the equipment itself can result in severe personal injury or damage to property. Only **qualified personnel** should be allowed to work on this equipment/system.

Qualified persons as referred to in the safety guidelines in this manual as well as on the product itself are defined as follows:

- ☐ System planning and design engineers who are familiar with the safety concepts of automation equipment;
- ☐ Operating personnel who have been trained to work with automation equipment and are conversant with the contents of the manual in as far as it is connected with the actual operation of the plant;
- ☐ Commissioning and service personnel who are trained to repair such automation equipment and who are authorized to energize, de-energize, clear, ground and tag circuits, equipment and systems in accordance with established safety practices.

2.3 Danger Notices

The notices and guidelines that follow are intended to ensure personal safety, as well as protecting the product and connected equipment against damage.

The safety notices are warnings for protection against loss of life (the users or service personnel) or for protection against damage to property are highlighted in this manual by the terms and pictograms defined here. The terms used in this manual and marked on the equipment itself have the following significance:

Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Note

is an important information about the product, its operation or a part of the manual to which special attention is drawn.

Attention

hints in this documentation to special safety-related guidelines, which equates the safety level of "Caution" and "Note".

This pictogram is used in relationship with **Danger, Warning and Caution** to hint to very important points of the documentation

4 Proper Usage

The equipment/system or the system components may only be used for the applications described in the catalogue or the technical description, and only in combination with the equipment, components and devices of other manufacturers as far as this is recommended or permitted by HERAEUS Electro-Nite.

The product described has been developed, manufactured, tested and the documentation compiled in keeping with the relevant safety standards. Consequently, if the described handling instructions and safety guidelines described for planning, installation, proper operation and maintenance are adhered to, the product, under normal conditions, will not be a source of danger to property or life.

Warning

After opening the housing or the protective cover or after opening the system cabinet, certain parts of this equipment/system will be accessible, which could have a dangerously high voltage level.

Only suitably qualified personnel should be allowed access to this equipment/system.

These persons must be fully conversant with any potential sources of danger and maintenance measures as set out in this manual.

It is assumed that this product be transported, stored and installed as intended, and maintained and operated with care to ensure that the product functions correctly and safely.

Notes on planning and installation of the product

e the product will mostly be used as an element of a larger system or plant, instructions are to be given with these for safe integration of the product into its environment.

ollowing facts are to be paid special attention:

Note

if a high degree of planned safety has been achieved when projecting an automation installation, e.g. through multi-nel structure, it is still nevertheless essential to follow the instructions contained in this manual, since any precautions vent hazardous faults can be made ineffective or create additional sources of danger through incorrect handling.

ctions below to be followed - depending on application - for installation and commissioning of the product:

Warning

The safety and accident prevention regulations are to be observed that are applicable to the specific application.

Devices for installation in casings or cabinets may only be run or operated when installed, desk-top devices or portables only with the casing closed.

In the case of hard-wired installations (fixed devices/systems) without all-pole mains isolator switch and/or fuses, a mains isolator switch or a fuse is to be built into the building wiring; the plant is to be connected to an earth conductor.

- In the case of devices/systems with hard-wired, non-removable connecting cable and without all-pole mains isolator switch, the earthing-contact socket for the device must be mounted close to the device and be easily accessible.
- In the case of devices operated with mains voltage, it is essential to check before putting the device into operation that the nominal voltage range set on the device agrees with the local mains supply.
- In the case of a 24 V supply, safe electrical separation of the low voltage is to be ensured. Only use power supplies manufactured in conformity with IEC 364441 or HD 384.04.41 (VDE 0100 Part 410).
- Fluctuations or divergences in the mains voltage from the nominal rating must not exceed the tolerance limits stated in the technical specifications, otherwise electrical assemblies / installations may be subject to functional defects and hazardous states.
- Precautions are to be taken to ensure that an interrupted programme can be properly resumed after a voltage drop and loss. A hazardous operational state must not arise even for short periods.
- Emergency stop devices conforming with EN 60204 / IEC 204 (VDE 0113) must remain effective in all operating modes of the automation installation. Unlocking of emergency stop devices must not cause the plant to start running again in an uncontrolled or undefined way.

Caution

- Mains connection and signalling wires are to be installed in such a way that stray inductive and capacitive pick-ups do not cause automation functions to be impaired.
- So that a loss of power or a conductor break on the signal side cannot result in undefined conditions in the automation plant, appropriate safety precautions are to be taken in relation to hardware and software when coupling the inputs and outputs.
- Automation systems installations and their controls are to be installed in such a way that they are adequately protected from being operated unintentionally.

2.6 Active and passive faults in an automation installation

- Depending on the task of the electronic automation installation, both **active** and **passive** faults can be **hazardous** faults. In a drive control system, for example, the active fault is generally hazardous because it results in unauthorised switching on of the drive. In the case of a warning function, in contrast, a passive fault may prevent a hazardous operating condition being signalled.
- It is important to differentiate possible faults in this way and to classify them into hazardous and non-hazardous depending on the task in question when considering all safety aspects of the product supplied.

Warning

Anywhere that faults arising in the automation installation could cause major material damage or even personal injury, i.e. could be hazardous faults, additional external precautions must be taken or mechanisms provided that will guarantee or compel safe operation even in the event of a fault (e.g. through independent limit switches, mechanical locking arrangements etc.).

Procedures for Maintenance and Repair

easurement or testing work is to be carried out on an active unit, the rules and regulations contained in the "VBG 4.0 dent prevention regulations" of the German employers liability assurance association (Berufsgenossenschaften) must be rved. Particular attention is drawn to paragraph 8 "Permissible exceptions when working on live parts". Use only suitable rical tools.

Warning

Repairs to an item of automation equipment may only be carried out by **HERAEUS Electro-Nite service personnel**. For replacement purposes, use only parts or components that are contained in the spare parts list or listed in the "Spare parts" section of this manual. Unauthorized opening of equipment and improper repairs can result in loss of life or severe personal injury as well as substantial property damage.

Before opening the equipment, always remove the power plug or open the disconnecting switch.

Only use the fuse types specified in the technical specifications or the maintenance instructions of this manual.

Do not throw batteries into an open fire and do not carry out any soldering work on batteries (danger of explosion). Maximum ambient temperature 100◦ C. Lithium batteries or batteries containing mercury should not be opened or re-charged. Make sure that the same type is used when replacing batteries.

Batteries and accumulators must be disposed of as classified waste.

The following points require attention when using monitors:
Improper handling, especially the readjustment of the high voltage or fitting of another tube type can result in excessive X-ray radiation from the unit. The license to operate such a modified unit automatically lapses and the unit must not be operated at all.

uidelines for Handling Electrostatically Sensitive Devices (ESD)

chips (MOS technology) are used in practically all HERAEUS Electro-Nite electronic modules. These VLSI components y their nature, very sensitive to overvoltages and thus to electrostatic discharge:

are therefore defined as "Electrostatically Sensitive Devices" "ESD" is the abbreviation used internationally.

Electrostatically Sensitive Devices

This pictogram and warning label used on the cabinets, sub-racks and packing suggests that electrostatically sensitive components have been used and that the modules concerned are susceptible to touch:

can be destroyed by voltage and energy levels that are far below the level perceptible to human beings. Such voltages y occur when a component or a module is touched by a person who has not been electrostatically discharged.
t cases, the components, which have been subjected to such overvoltages, cannot be immediately detected as faulty; lt occurs only after a long period in operation.

An electrostatic discharge

- ☐ of 3500V can be felt
- ☐ of 4500V can be heard
- ☐ must take place at a minimum of 5000V to be seen.

But just a fraction of this voltage can already damage or destroy an electronic component.

The typical data of a component can suffer due to damage, over-stressing or weakening caused by electrostatic discharge; this can result in temporary fault behaviour, e.g. in the case of

- ☐ temperature variations
- ☐ mechanical shocks and vibrations
- ☐ or change of load.

Only the consequent use of protective equipment and careful observance of the precautions for handling such components can effectively prevent functional disturbances and failures of ESD modules.

3.1.1 When is a Static Charge Formed ?

One can never be sure that the human body or the material and tools which one is using are not electrostatically charged.

Small charges of 100V are very common; these can, however, very quickly rise up to 35000V.

Examples of static charge:

☐	Walking on a carpet	up to 35000V
☐	Walking on a PVC flooring	up to 12000V
☐	Walking on a cushioned chair	up to 18000V
☐	Plastic desoldering unit	up to 8000V
☐	Plastic coffee cup	up to 5000V
☐	Plastic bags	up to 5000V
☐	Books, etc. with a plastic binding	up to 8000V

3.2 Important Protective Measures against Static Charge

- ☐ Most plastic materials are highly susceptible to static charge and must therefore be kept as far away as possible from ESDs.

- ☐ Personnel who handle ESDs, the work table and the packing must all be carefully grounded

- ☐ Personnel who handle with CMOS components or with CMOS components on assemblies should wear anti static clothes (e.g. cotton). Do not wear clothes of nylon.

3.3 Handling of ESD Modules

- ☐ As a matter of principle, electronic assemblies should only be touched where this is unavoidable as a result of the work to be carried out to them.
  The assemblies or components should, where possible, be held in such a way that module pins or strip conductors are **not** touched directly.

- ☐ Components should, as a matter of principle, only be touched if
  a) you are continuously earthed by means of an electrically conductive armband, or if
  b) the shoes - via protective earthing strips - are in contact with an electrically conductive floor.

- ☐ Before touching electrostatically sensitive assemblies and components with tools (pliers, screwdrivers etc.), it is important to make sure that the object is discharged. This can be simply done by touching a conductive earthed object, such as a water pipe or earthed switch cabinet, shortly beforehand.

- ☐ The assemblies or dismantled components must not be allowed to touch chargeable and highly insulated materials such as plastic film, insulating table tops, clothes of man-made fibres.

- ☐ Dismantled assemblies may only be placed on a conductive base or stored in a conductive packaging.
  In the case of assemblies that include a battery / accumulator / clock module (with integrated lithium cell), it is important to ensure that the connections of the assembly never come into contact with the conductive surface, or are even short circuited ; if necessary, the connections are to be covered beforehand with insulating tape or insulating material.

- ☐ The surface of the worktop should be covered with a conductive material and connected to an earthing connection.

- ☐ In the case of CMOS components that are not installed, the contacts (pins) should be short circuited with a conductive sponge rubber mat or the component should be plugged into conductive foam.

- ☐ CMOS components must under no circumstances be inserted into or removed from assemblies when there is voltage is present.

- ☐ Measurements may only be taken on assemblies / components that are sensitive to electrostatic discharge if
  a) the measuring device is earthed (e.g. via the earthing conductor) or
  b) in the case of a potential-free measuring device, the measuring head is discharged on an earthed object shortly before taking the measurement.

- ☐ Only an earthed soldering iron may be used to solder on the assemblies.

3.4 Shipping of ESD Modules

Anti-static packing material must always be used for modules and components, e.g. metallized plastic boxes, metal boxes, etc. for storing and dispatch of modules and components.
If the container itself is not conductive, the modules must be wrapped in a conductive material such as conductive foam, anti-static plastic bag, aluminium foil or paper.
Normal plastic bags or foils should not be used under any circumstances.

For modules with built-in batteries ensure that the conductive packing does not touch or short-circuit the battery connections: if necessary cover the connections with insulating tape or material.

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Date of issue: 15.01.2001

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HERAEUS Electro-Nite further reserves the right to alter the specification of the product without obligation to notify any person or organisation of these changes.

Improvements or instrument changes which have been added after this document was printed are found on one or more pages which are enclosed at the end of this manual.

We ask you to take note of these extra sheets.

Hagen, 15.01.2001

On all instrument boards are electronic components that can be damaged through static discharge. These boards should only be changed or set by qualified personal who are familiar with these electrostatic components. The necessary safety guideline and security concepts have to be kept through all work on this equipment.

Table of contents

1 Brief Description

The operation of the measuring unit is entirely menu-assisted. All messages, operating steps, measurement results etc. are presented in clear text, in several optional languages, on the integrated 9" display. The two measurement input channels for temperature and EMF are galvanic isolated from each other, and from the remaining system in order to exclude any effect on probe, measuring lance or compensation line.

The Multi-Lab Celox is ready for operation after connecting the mains supply and measuring lance.

The monitor displays the operating and signalling conditions

"READY", "SLAC", "MEASUREMENT" and "END".

The "READY"-message indicates measuring readiness with a temperature or Celox probe mounted on the lance and "SLAC" indicates measuring readiness with a mounted Celox-SLAC probe.

"MEASUREMENT" indicates measurement in progress and analytical processing by the unit.

The **"END"** message signals the termination of a measurement cycle and is the command to remove the probe from the melt.

The PC-based unit ensures optimal evaluation of the converted EMF and temperature readings. Plateau determination is made by calculatory arithmetic tolerance comparison and determination of mean values. The determined oxygen and temperature values are displayed on the monitor until the next measurement is made and are stored. Via screen menus, these stored measurements can be retrieved from the memory both for display on the monitor and printout.

Failures during the measuring cycle, e.g. error measurements, sensor or cable break, are showing by flashing "END" signal. The nature of the error measurement is clearly displayed on the screen.

Various parameters including type of element, language, measuring time, start value, RS-232-parameters, formula parameters can be changed by the user via self-explanatory screen menus.

The following outputs are available:
signal outputs "READY", "MEASUREMENT", "END", "ERROR MEASUREMENT", "CELOX", "HORN", Centronics printer interface, 2 serial RS-232 interfaces, max. 4 BCD-outputs (optional), max. 2 0/4...20mA-outputs (optional), bath level detection board type DIST (optional).

2 Industrial Applications

The main areas of application of the instrument are temperature and oxygen measurements, calculation of aluminium and carbon contents in steel, iron and non-ferrous melts and slag oxygen activity determination (SLAC measurement).

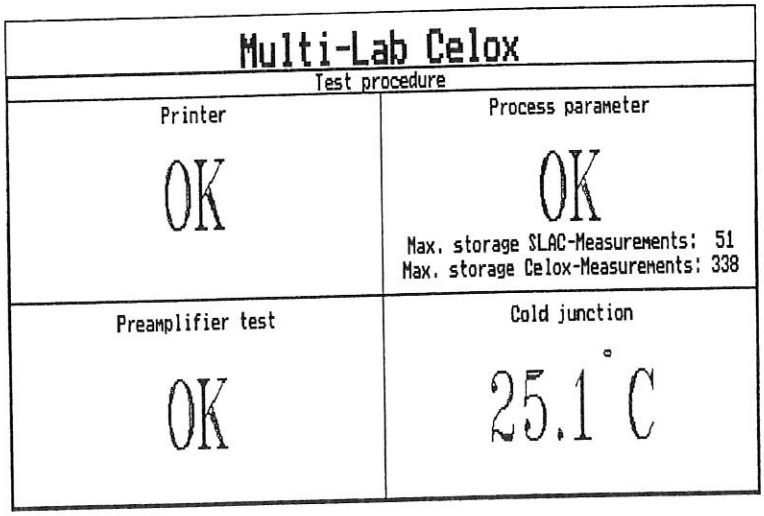
The Multi-Lab Celox may be adapted to any operation condition and steel grade by changing some process parameters.

Oxygen and temperature are measured by using immersion lances and associated oxygen probes (Celox), temperature probes (Positherm) or slag oxygen activity probes (SLAC).

3 Equipment Commissioning

After connection of mains cable and immersion lance, Multi-Lab is ready for operation after an initially period of approx. 1 min.

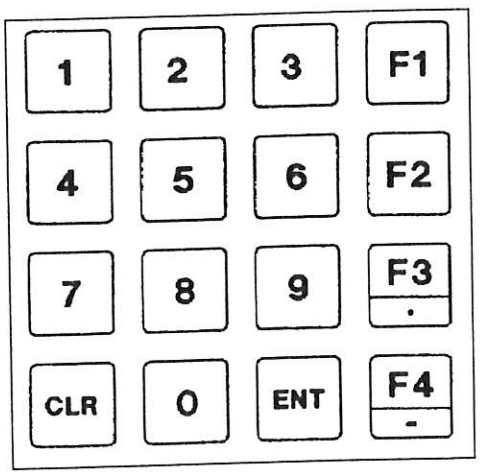
After switching on the instrument with the mains switch the program starts several internal tests. For several seconds an instrument identification picture is shown in which the program version number is shown in the right corner. Afterwards the Multi-Lab starts some more system tests. After running these tests successfully the following picture is displayed:



The unit works either with the standard process parameters set by the manufacturer or with the most recently programmed customer parameters.

4 Membrane Keypad

The Multi-Lab keyboard is a 16 key membrane keypad. The film material is mode of tough plastic. A definite pressure point ("click") can be noticed when pushing the touch switches.



The figures <**0**> through to <**9**> are for numerical input. The <**ENT**> key always serves as the transfer key. The <**CLR**> key is used first for clearing numerical input errors, and secondly as a special function key in connection with a figure. The four other keys enable the following functions to be activated quickly:

1. <**F1**> for starting the main menu, or for forward paging in the menus.

2. <**F2**> for entering the heat number, or for backward paging in the menus.

3. <**F3**> for activating the screen printout, or for entering a decimal point.

4. <**F4**> to select different parameters for three steel qualities.
   With numerical input, the digit sign can be changed by means of this key.

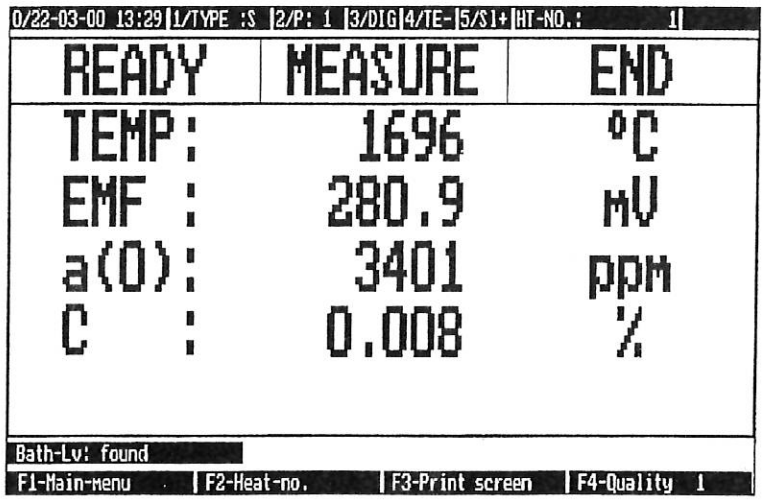
5 Screen

The screen consists of three zones:

status line

result-/ display-field

menu line



If this measurement diagram is displayed and no changes take place within the selected screen saver interval, then the screen is switched off (no key pressed and no change inside the measurement circuit). On the screen appears a moving rectangle with the message:
<press any key to continue>

5.1 Status Line

The status line shows parameters that the user may change or start with the <**CLR**> key and a number. First the <**CLR**> key is pressed. Then an entry field will appear asking for the desired number.

Key	No.	Function
CLR	0	Setting date and time
CLR	1	Switch over of thermocouple type
CLR	2	Input of measurement location number
CLR	3	Switch over graphic and digital display
CLR	4	Mark for a test measurement
CLR	5	Enable SLAC measurement On / Off

5.1.1 Setting Time and Date <CLR><0>

An entry field appears with the request to enter the time. Hours and minutes must be entered two-digit form, separated from each other by means of a full stop. The entry is terminated with the <**ENT**> key. The date may be changed after this entry. The date is entered two-digit form in the order MONTH/DAY/YEAR, separated by full stops. This entry must also be finished with the <**ENT**> key.
If there is no need to change the time/date, the menu is leaving by pushing <**ENT**> twice.

5.1.2 Switch-Over of Thermocouple Type <CLR><1>

The entry of a security code number protects the sensor type selection from any unauthorised change. After correct entry of the code (standard code is **2448**), a further input field will appear in which the sensor type (linearisation) can be changed by means of the <**F3**> key. The status line displays the current setting. Linearisation is possible for following types of sensors:

S = Pt10%
R = Pt13%
B = Pt18%.

5.1.3 Manually Entry of a Measurement Location Number <CLR><2>

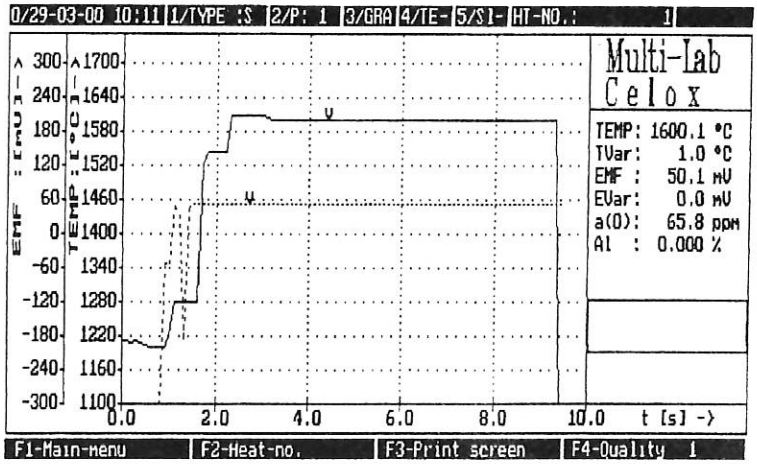
The measurement location entry is activated by the key combination <**CLR**><**2**>. A two-digit measurement location number can be entered or the former value can be taken over by the <**F1**> key.

If an external location input is connected to the Multi-Lab it is not possible to select a different number with the keypad.

5.1.4 Graphic Display <CLR><3>

(Not possible with continuos measurement)

Switch over between graphic display with temperature and EMF-traces or digital display with large figures.



The "v"-Symbol marks the temperature resp. the EMF-plateau in the measuring traces.

5.1.5 Mark of a Test Measurement <CLR><4>

<**CLR**><**4**> sets the heat number of the following measurement to 99999999 as the flag of a test measurement. The heat number is reset to its former value by repeated pushing of <**CLR**><**4**> or automatically after the completed test measurement.

5.1.6 Oxygen measurement in Slag <CLR><5>

If a oxygen measurement shall be carried out in slag (with a SLAC sensor), this measurement has to be switched on before by means of <**CLR**> <**5**>. (status line displays 5/SIs+). To guarantee reliable Celox measuring and reliable measurements with a test instrument the SLAC measurement should be disabled after the measurement. <**CLR**> <**5**>. (status line displays 5/SI-).

5.1.7 Print last Measuring Results <CLR><6>

The measuring results of the last measurement are printed in the data print form on a Centronics Printer or a printer connected to the serial interface. This action is useful only if the connected printer is not in auto-print mode or to repeat the last printing.

5.1.8 Initialise Printer <CLR><7>

The initialisation of the printer is important after changing of paper. The printer and Multi-Lab are set to the correct beginning of paper.

5.1.9 Transmit Measuring Results to Both Serial Outputs <CLR><8>

The serial interfaces can be tested by pushing this key combination. The results of the last measurement are transferred via both serial interfaces (RS232).

5.1.10 Flashing "READY"

Flashing **"READY"** in the status line means that the Multi-Lab is active. **"READY"** does not flash during printing, self-calibration or if a measurement is in operation.

5.2 Result and Display Field

The measurement and analytical results are displayed in this field in large figures, also the measurement sequence.

5.3 Menu Line

The meaning of the function keys is shown in the menu line. The menu line consists of four fields:

5.3.1 Main Menu <F1>

The main menu appears after pushing the <**F1**> function key. The sub-menus are described in the next chapter. With the <**ENT**> key it is possible to switch back to the normal measuring screen. It is possible to take measurements even if a menu screen is shown but it is not possible to branch to the main menu during a measurement.

5.3.2 Setting the Heat Number <F2>

The <**F2**> function key activates an entry field to enter an 8-digit heat number. Valid values are in the range 0 - 99999997. The entry must be terminated with <**ENT**>. By pushing the <**F1**> function key, the current heat number can be increased by 1.

3 Printer Activation <F3>

<**F3**> function key activates a hard copy screen printout to a connected parallel or serial
er. This function is not available when a decimal point is expected with a numeric entry.

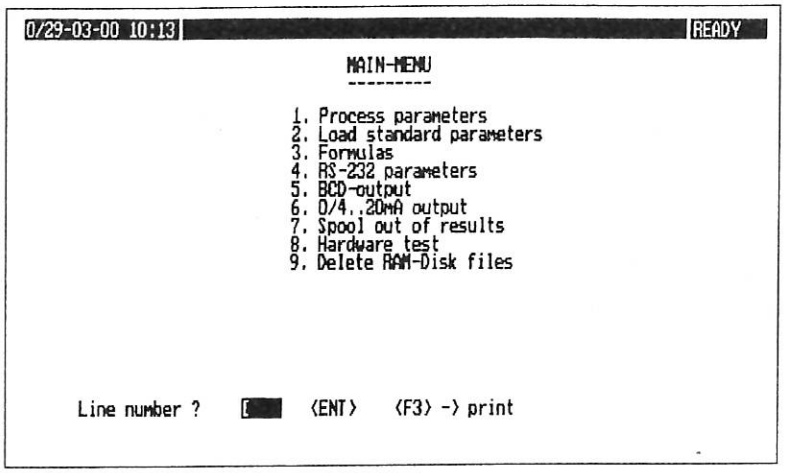
4 Quality Switch-Over <F4>

<**F4**> function key allows switching between three different parameter lists and formulas, for
ent steel grades. The standard parameters for these qualities are the same. After entry of
and correct entry of the security code, a further input field will appear in which the quality
ber can be changed by means of the <**F3**> key. The menu line displays the current setting.

No.	Parameter
1	Temperature start value
2	Temperature tolerance
3	Temperature plateau length
4	Max. temperature measurement time
5	EMF start value
6	EMF tolerance
7	EMF plateau length
8	Max. EMF measurement time
9	SLAC Maximum noise
10	SLAC Maximum slope
11	SLAC Maximum shape
12	SLAC delay to start
13	SLAC Minimum slope to start measurement
14	SLAC Maximum measurement time
15	Type of thermocouple
16	All selectable formula parameters

6 Main and Sub-menus

Pushing of the <**F1**> key causes the main menu to appear on the screen:



The Multi-Lab program is branching into the corresponding menu by entering the desired menu numbers and pushing the <**ENT**> key. To protect the unit from unauthorised operation, a **security code** must be entered first. After correct entry of this code and followed by the <**ENT**> key, the selected menu will appear. By repeated pushing of the <**ENT**> key the unit will exit the menu; at any stage the screen can be printed out on a connected parallel or serial printer by means of the <**F3**> key. The <**F1**> and <**F2**> keys allow forward and backwards paging through the sub-menu items.

6.1 Process Parameter Menu

6.1.1 Process Parameter

With these parameters it is possible to directly influence the measurement and processing of the measured results. The selected parameter can be changed following the entry of a line number. The entry must be terminated by pushing the <ENT> key.
The following process parameters can be changed:

No.	parameter	**standard-value**	Max value	Min value	unit
1.	Temp. start value	**1100**	1700	400	°C
2.	Temp. tolerance	**3.0**	10.0	1.0	°C
3.	Temp plat. length	**1.2**	5.0	0.5	sec
4.	Max temp meas. time	**6**	12	4	sec
5.	Temp. filter samples	**1**	5	1	
6.	EMF-start value	**-300.0**	200.0	-400.0	mV
7.	EMF-tolerance	**5.0**	10.0	1.0	mV
8.	EMF-plat. length	**1.2**	5.0	0.5	sec
9.	Max. EMF-meas. time	**10**	12	8	sec
10.	EMF-wait.-period	**4.0**	5.0	1.0	sec
11.	EMF filter samples	**1**	5	1	
12.	Signal time "END"	**2**	5	1	sec
13.	Security code	**2448**	99999	0	
14.	Transmission-complete-pulse	**1.0**	10.0	0.1	sec
15.	Cont. measure interval time	**15**	120	10	sec

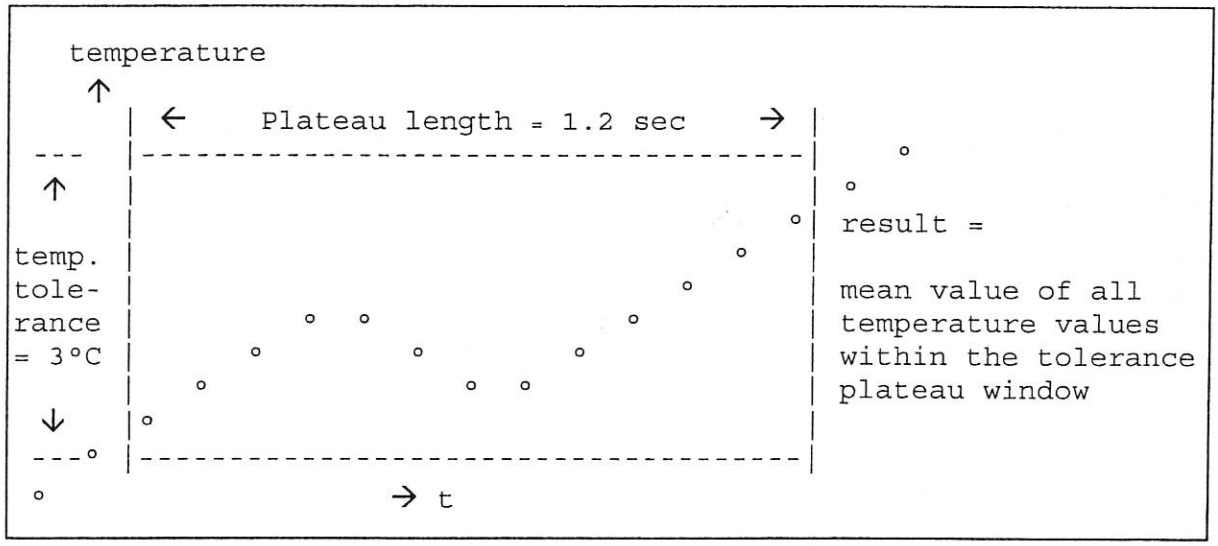
When Multi-Lab is switched on for the first time, the standard parameters are loaded immediately.

6.1.1.1 Initial Temperature Value

This parameter determines the temperature at which the measurement starts. If the measured value is higher than or equal to the initial temperature setting, then the measurement sequence is initiated.

6.1.1.2 Temperature Tolerance

A temperature plateau is attained when the measured temperature variation is less than the temperature tolerance setting and is constant over the set plateau length. Multi-Lab calculates the mean value of all temperature values measured during this period (in 100 msec intervals) and displays this mean value as the result of measurement. (e.g. plateau length = 1.2s means, the result is the mean value of 12 smoothed samples)
The "Temperature tolerance" parameter determines the upper and lower limits that must not be exceeded. If, for example, the standard value of 3.0°C has been set then the max. acceptable temperature variation over the plateau length may be 3°C.



6.1.1.3 Temperature Plateau Length

(see point 6.1.1.2)

6.1.1.4 Max. Temperature Measuring Time

When an "only" temperature measurement (e.g. with Positherm) is made, the measuring period commences when the temperature start value is exceeded. The measurement is terminated at the latest at the end of the "Max. temperature measuring time".

6.1.1.5 Temperature Filter Samples

Sets the number of samples to be read and averaged for calculating the temperature plateau. It is possible to calculate the average of up to 5 samples. The plateau length is not involved by the filter, only the beginning of the plateau is shifted by the filter count setting (count-1 * 1/10sec) for example: plateau length = 1,2sec = the mean values of 12 filtered samples builds the result.
It is possible to select filter counts from 1...5. Select 1 to turn the filter off.

6.1.1.6 EMF Start Value

When using a Celox sensor, this parameter determines the mV value at which the EMF measurement is to start. When the measured value is higher than or equal to the "EMF start value" setting, then Multi-Lab switches to Celox measurement.

6.1.1.7 EMF Tolerance

"EMF tolerance" have the same function as "temperature tolerance" described under section 6.1.1.2

6.1.1.8 EMF Plateau Length

(see point 6.1.1.3)

6.1.1.9 Maximum EMF Measuring Time

If a Celox measurement is recognised, this time is use for the maximum measuring time. If no EMF plateau is identified during this period a measurement error will be indicated.

6.1.1.10 EMF Waiting Period

Certain process and physical conditions may result in an undefined state at the beginning of the EMF measurement. In this situation the waiting period can be set to ignore the initial voltage behaviour. Only after the end of the "EMF waiting period" the unit will decide if there is a Celox measurement. If the EMF start value is also exceeded, Multi-Lab will commence the Celox measurement.

6.1.1.11 EMK Filter Samples

(see point 6.1.1.5)

6.1.1.12 Signal Time "END"

Upon termination of a measurement, there is a screen display of this condition. Simultaneously the "END" relays on the signalling board are activated. The duration of this signal period can be set with this parameter.

6.1.1.13 Security Code

Before parameters can be changed, a security code is requested to avoid any unauthorised use. (Standard setting: **2448**). During the code word input only xxx is displayed.

6.1.1.14 Transmission Complete Pulse

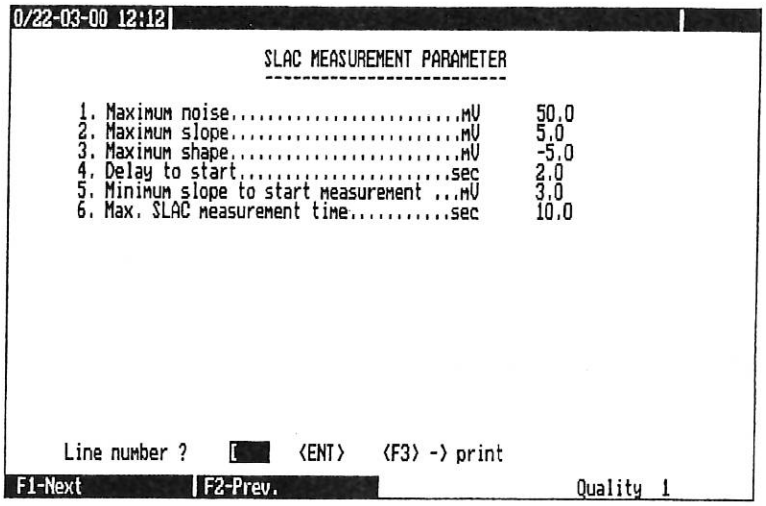
After termination of the data transfer of the second serial RS232 interface, a relay contact is closed. The closed contact period can be set with this parameter. This contact is available at the measuring place input connector.

6.1.1.15 Interval Time with Continuous Measurements

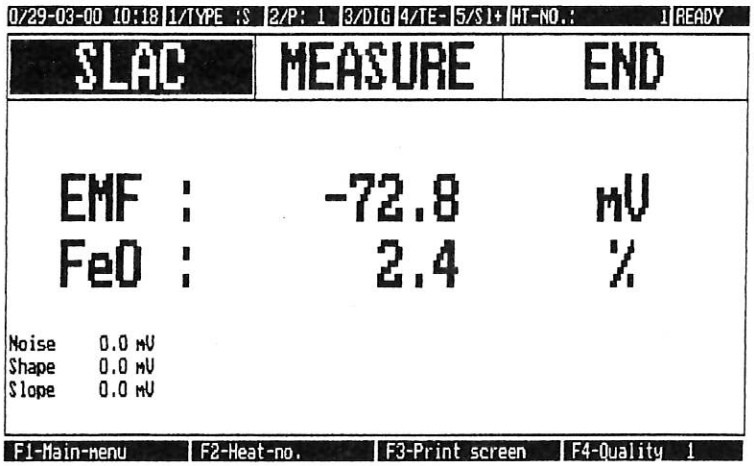
In continuous temperature measurement mode this period is the time between two data outputs on the serial RS232 and BCD-output. For this purpose, the continuous measuring function must be activated.

2 Parameters of SLAC measurement

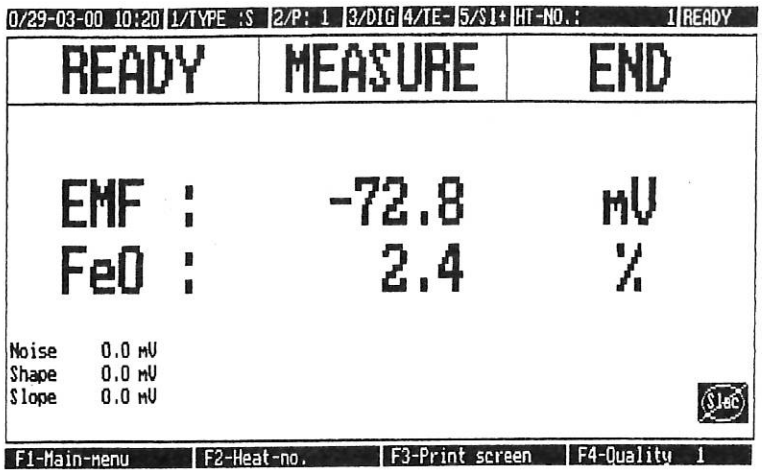
parameters of SLAC measurement are shown with this menu and can be changed. The ation of parameters describes chapter: 6.1.1.



arks about the course of SLAC measurement:
o the SLAC measurement it is necessary to enable this special measurement first. This ens in the measurement diagram by pushing the keys **< CLR > < 5 >** .
status line shows **5/SI+**.
connecting the SLAC sensor the signalling field displays "SLAC". At the measurement on the "READY" signal lamp flashes three times to signal that a SLAC sensor has been gnised.



Attention: It is **not possible to do a SLAC measurement**, if the lance insulation is less than the minimum insulation value. In that case the display shows the sign **~~SLAC~~**.



6.1.2.1 Maximum noise

This parameter determines the maximum of noise, which may occur on the plateau of the measured curve. If this measured noise is larger than this oriented value, the measurement is cancelled with a failure report, if there was no plateau found before. Lower values of this parameter shorten the possible duration of the measurement.
(range: 0...100mV, standard: 50mV)

6.1.2.2 Maximum slope

If the maximum slope is fallen below the oriented value the plateau evaluation starts.
(range: 0...30mV, standard: 5mV)

6.1.2.3 Maximum shape

If the maximum shape is exceeded, the measurement is recognised as faulty and is cancelled.
(range: -25...0mV, standard: -5mV)

6.1.2.4 Delay to start of measurement

The parameter serves to detect the start of the measurement. If the sum of magnitude of the first derivation of the measurements curve within this time is larger then the oriented value of point the measuring starts.
(range: 0,5...3s, standard: 2 s)

6.1.2.5 Minimum slope to start measurement

The slope has to be greater than the selected slope during the complete delay time to start the measurement.
(range: 0 ... 100 mV, standard 3 mV)

6.1.2.6 Maximum SLAC measurement time

The menu item defines the maximum measurement time in which the measurement result must be found. If this time is exceeded, the measuring interrupts with failure report.
(range: 4sec ... 20sec, standard 10 s)

6.1.3 Program Options

The program options function allows changes to be made in the program sequence and in the mode type. By selection of the line number and pushing <**F3**>, the desired change is made and displayed at the right screen margin. The entry must be concluded with <**ENT**>.

(**standard**)

1. Horn.....	**ON**	/ OFF
2. "END" signal at error measurement.....	**FLASHING**	/ CONTINUOUS
3. Print mode.....	**HARDCOPY**	/ DATA
4. Automatic print out.....	**OFF**	/ ON
5. Mode for date display.....	**EUR**	/ USA
6. Fahrenheit / Celsius.....	**CELS**	/ FAHR
7. Auto. Celox element switch-over.....	**OFF**	/ S / R / B
8. Continuous measurement.....	**OFF**	/ ON
9. Language.....	**ENGLISH**	/ GERMAN
10. Data Logic "Measurement Place".....	**inverted**	/ non inverted
11. Heat-no. +1 at start of measurement....	**OFF**	/ ON
12. Screen Saver.....	**5min**	/ 1/10/15/OFF
13. Linearisation.....	**IPTS68**	/ IPTS48

6.1.3.1 Horn

Apart from the actual "END" signal, Multi-Lab can additionally activate a relay contact for a horn or a buzzer. A horn connected to socket 3 of the unit can be switched "on" and "off" by means of this parameter.

6.1.3.2 "END" Signal at Error Measurement

The end of a measurement is indicating by the "END" signal. If the measurement was faulty, the "END" signal can be switched to "flashing" by means of this parameter.

6.1.3.3 Print Mode

If a measurement is to be documented this provides a choice whether the screen content (hardcopy) or only the data is to be printed after every measurement.
Example data print:

```
                M U L T I - L A B     C E L O X
                -------------------------------

  Date      Time  Heat-No  Place  Temp    EMF      % C    %Al    a(O)
|--------------|--------|-----|-------|-------|------|------|------|
| 24-11-00 13:59|12345678|    1| 1651.0| -119.8|      | 0.010|  9.13|
| 24-11-00 14:05|       1|    7| 1591.2|  150.5| 0.107|      | 243.5|
| 24-11-00 15:34|       2|   10| 1651.0|  -29.8|      | 0.000| 31.80|
| 24-11-00 15:55|  789524|   18| 1653.8|  198.9| 0.036|      | 773.8|
```

6.1.3.4 Automatic Print-Out

If the automatic printout function is switched on and a parallel or serial printer is connected to the unit, a printout is made automatically after each measurement. If automatic printout is off, the desired measurement may be printed out with <**F3**> as a hardcopy.

6.1.3.5 Mode for Date Display

Here the display format for the date is set. "EUR" indicates the day/month/year sequence, "USA" the month/day/year sequence.

6.1.3.6 Fahrenheit / Celsius

This option selects the temperature unit °C or °F.

6.1.3.7 Automatic Celox Element Switch-Over

When using different types of thermocouples for Positherm and Celox measurements, automatic switch-over to the thermocouple of the Celox sensor is possible. Thus, for example, type R can be chosen for Positherm and type S for Celox.

6.1.3.8 Continuous Measurement

If this option is selected, the measured and analytical values are displayed continuously. Storage of measured data is not possible in this mode of operation. The measured data are outputted via the RS-232 and BCD outputs at adjustable intervals.

6.1.3.9 Language

This allows all menus, parameter settings and measurement results to be displayed in English, German or French.

6.1.3.10 Data Logic "Measurement Place"

The data may be read in inverted or non-inverted form (non-inverted: Digit-"0" -> contact open).

6.1.3.11 Heat-no.+1 at start of measurement

The heat-no increases by 1 prior each measurement if this function is selected. The value at the beginning is the current heat-no. The heat-no runs from 1 - 99999997 and reset to 1 again.
The heat-no 99999998 marks a stored measurement that has been manipulated at the spool-out.
The heat-no 99999999 is reserved for test measurements.

6.1.3.12 Screen Saver

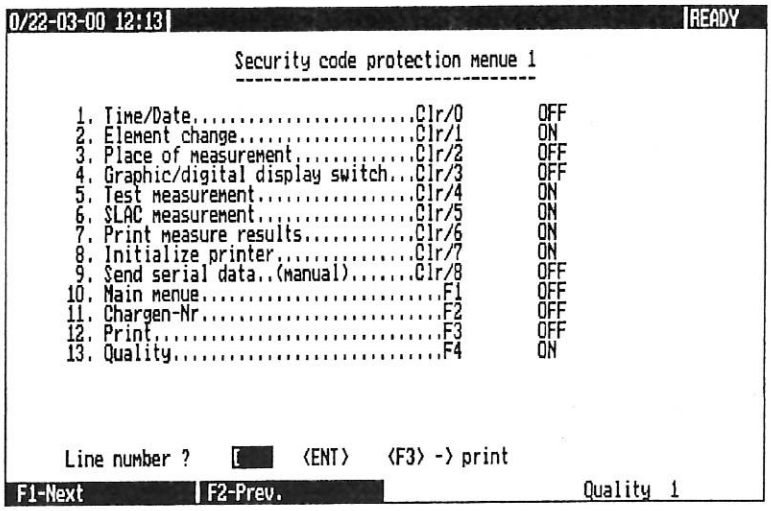
This function switches the display off after the selected interval. Possible intervals are 1, 5, 10, 15 min and OFF. Every key pushed or change inside the measurement circuit switch the screen on again. This function extends the lifetime of the display.

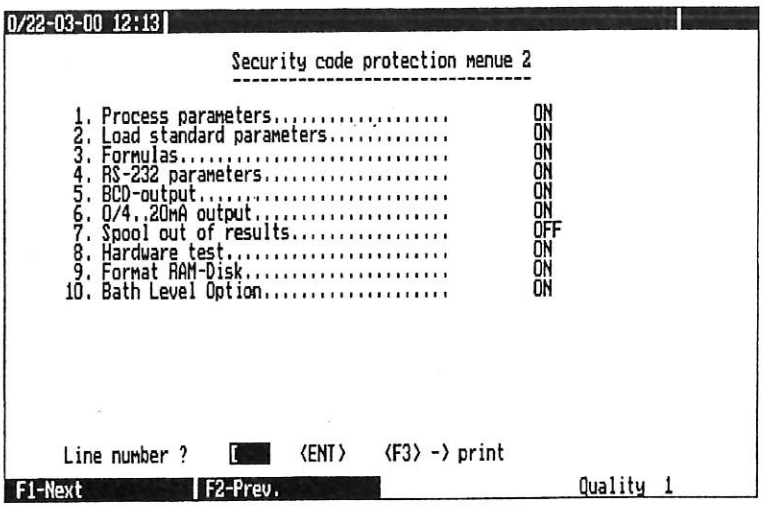
6.1.3.13 Linearisation Table IPTS68 / IPTS48

This switch toggles between the temperature calibration table IPTS68 and the still in some countries used IPTS48.

6.1.4 Configuration of Security Code

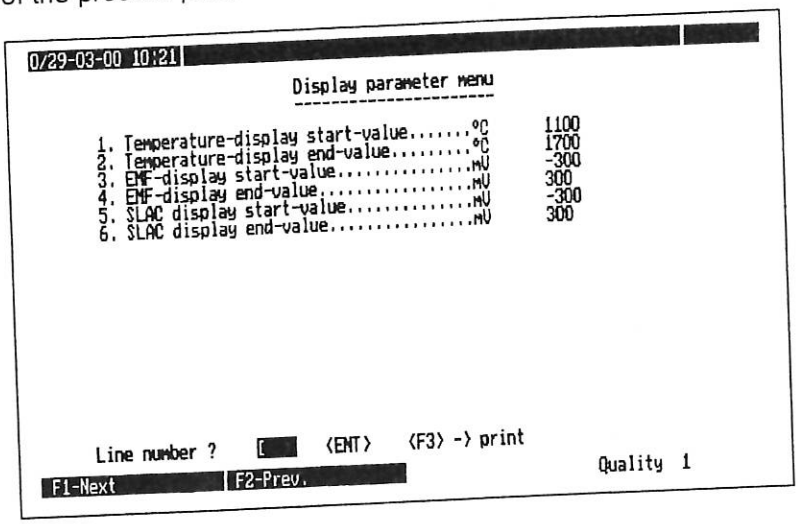
Each point of main menu, all <**CLR**> functions and all function keys <**F1**> till <**F4**> may be protected or not by the security code. The choice of protection can be configured in the following two menus.





6.1.5 Graphic parameters

The Y- scaling of the measurement graphic can be adjusted by changing the graphic parameters in the last section of the process parameters.



The smallest measuring range is 100°C or 100mV.

The X-scaling is set by the maximal measuring time.

No.	Parameter	Standard-value	Maximum value	Minimum value	Unit
1.	EMF display start val	-300	+300	-400	mV
2.	EMF display end value	+300	+800	-300	mV
3.	Temp. display start	1100	1700	400	°C
4.	Temp. display end val	1700	1850	500	°C
5.	SLAC display start	-300	+750	-800	mV
6.	SLAC display end	+300	+800	-700	mV

6.2 Load Standard Parameters

6.2.1 Load Standard Process-Parameters

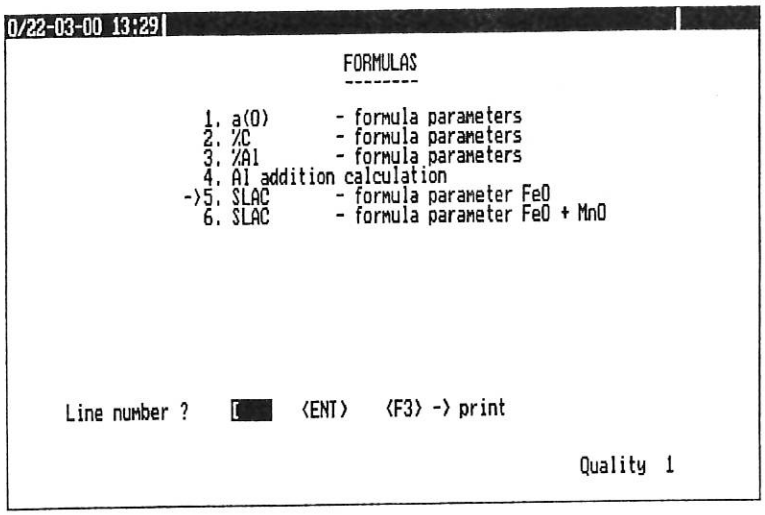
This menu resets all process parameters to the pre-set values. This means that the set **custom process parameters** and **formula parameters are cleared**. All set parameters for the RS-232, BCD, Bathlevel, and mA-outputs are preserved.

6.2.2 Load Standard I/O-Parameters

This menu sets the I/O parameters (RS-232, BCD, Bathlevel and mA) to the pre-set values. The Process and formula parameters remain untouched of this.

Formula

this function the calculation of oxygen, aluminium and carbon values can be influenced.

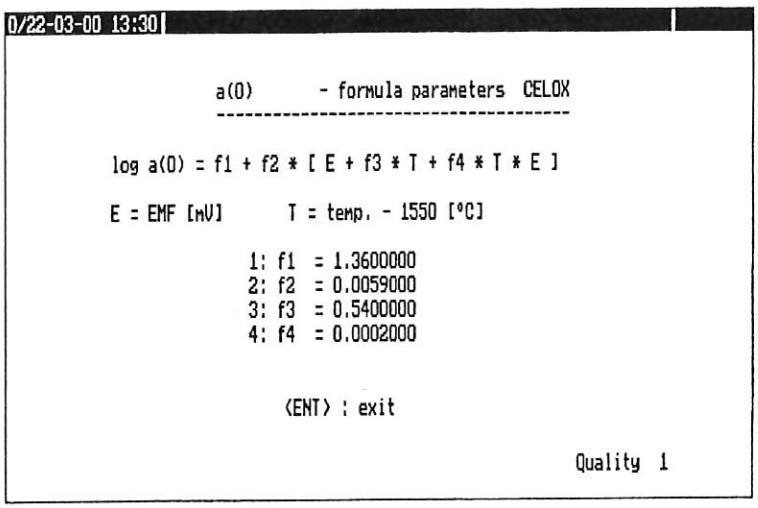


1 a(O) Formula Parameters

e is a choice of three formula types for the calculation of oxygen activity.

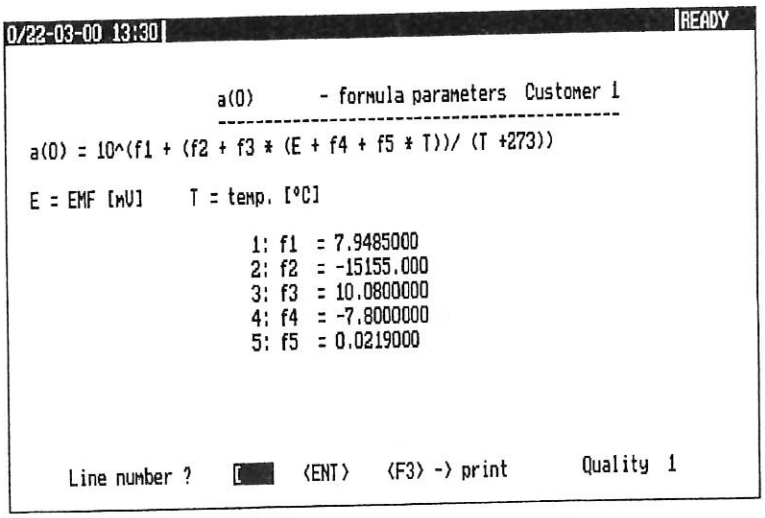
1.1 Celox Formula

Celox formula cannot be changed, but it is displayed upon selection of position 2.:



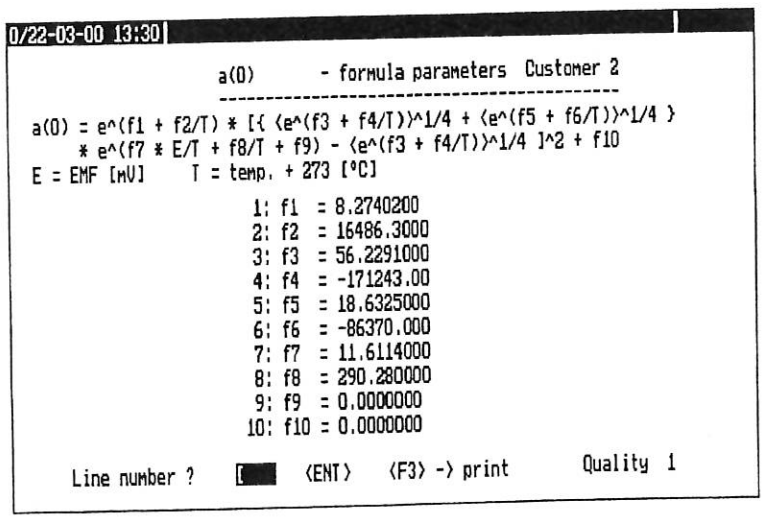
6.3.1.2 a(O) Customer Formula 1

The second formula (here called "custom formula 1") may be changed via the parameters. This formula is used for 100% Ni melting-charge. If the Fe content is <=30% this formula may be used with a correction routine.



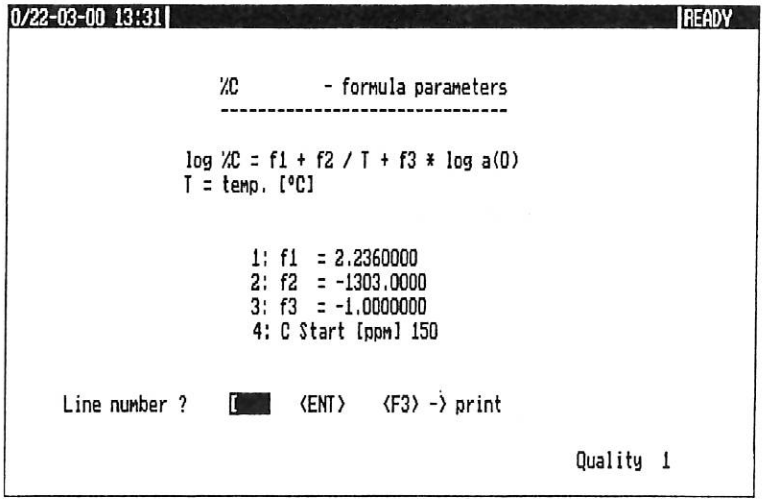
6.3.1.3 a(O) Customer Formula 2

The third formula (here called "custom formula 2") may also be changed via the parameters.



.2 %C Formula Parameters

n this option the parameters of the carbon calculation can be changed. The start of the %C - culation is chosen with item 4 from a(O) = 20 to 200ppm. The calculation of %C is possible en the a(O) value is greater then this start value and the EMF reach positive values. Standard ing is a(O) = 150 ppm.

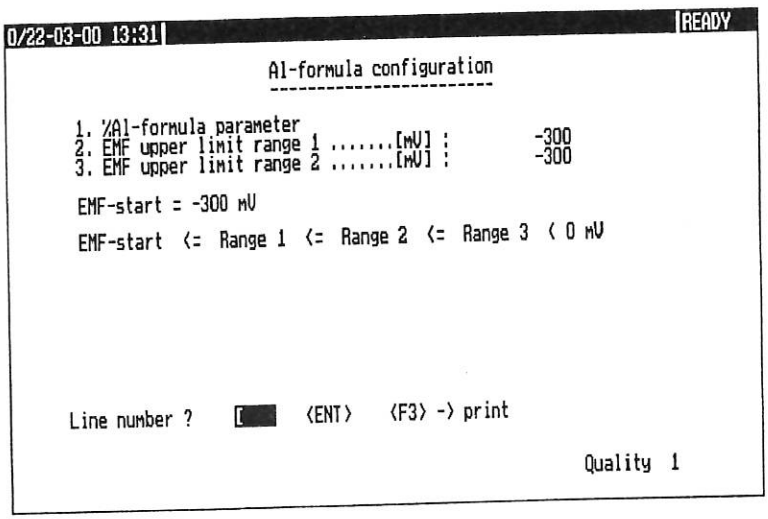


6.3.3 Al Formula

6.3.3.1 %Al Formula Configuration

The formula for the Al calculation can be divided into three EMF ranges each may be assigned with other constants.

Range 1: EMF start value <= EMF < upper limit range 1 (selectable)
Range 2: EMF upper range 1 <= EMF < upper limit range 2 (selectable)
Range 3: EMF upper range 2 <= EMF < 0 mV (not selectable)

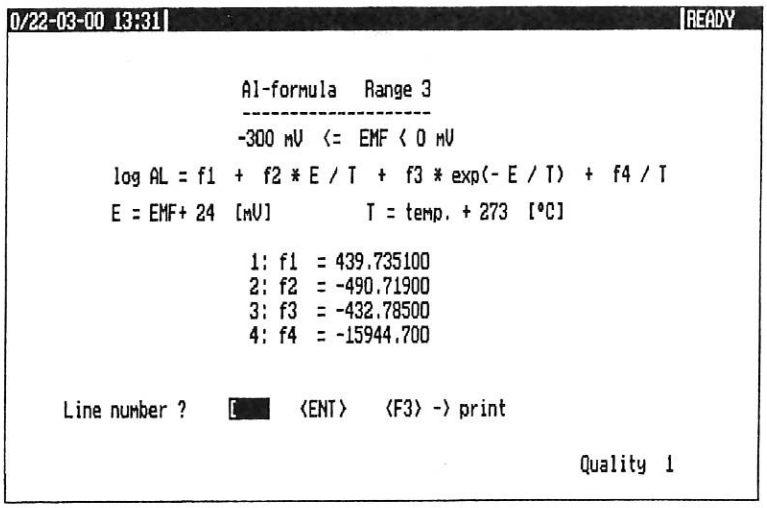


The standard setting is one formula range.(from EMF start-value to 0mV)
In this case both upper ranges and the EMF start-value are at the same level. If one constant is changed than this constant of the other two ranges change automatically.

The following description can only be taken notice of if the Al-formula should be divided into two or three ranges.
The values for the upper limits of range 1 and 2 may be changed. The ranges are coherent in that the upper limit of range 1 equals the lower limit of range 2. The upper range of range 2 must change first (between EMF start-value and 0V), then the range 1 may be changed (between start-value and lower range 2). Now three formula ranges are available.
The EMF start value (starting point of calculation) is only shown here. It can only be changed at the process parameter menu (see point 6.1.1.6).

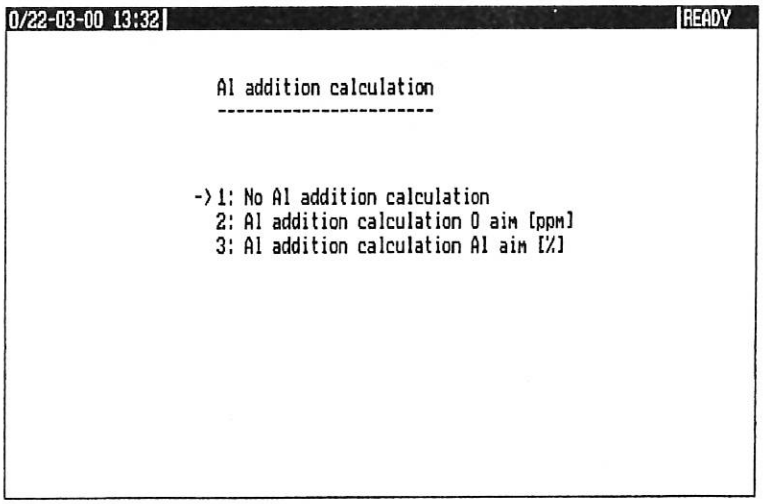
3.2 %Al Formula Parameter

figure shows the formula and the parameters. Multi-Lab shows the Al value in %.



4 kg-Al- addition calculation

calculation of the Al addition can be carried out in kg, if either an O aim (point 2) or an Al aim
: 3) in the menu "Al addition calculation" is selected. A result is shown only, if the result of
lation is greater that zero.

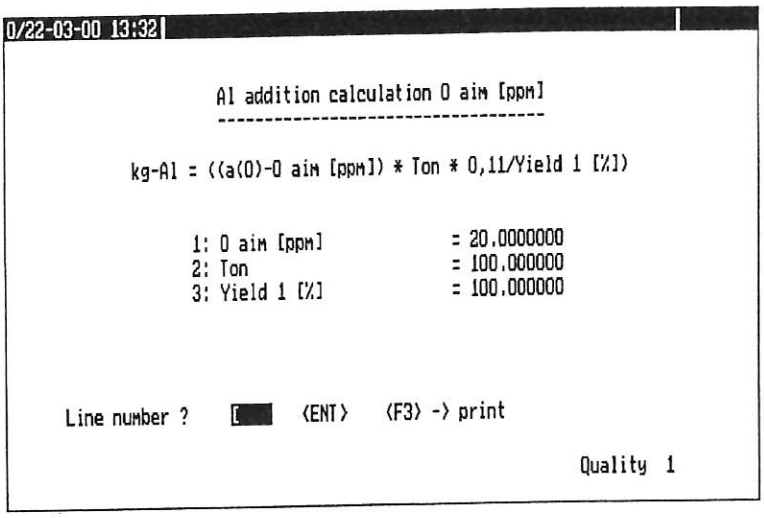


4.1 No Al-addition calculation

point is chosen, the calculation is switched off.

6.3.4.2 Al-addition calculation with O aim

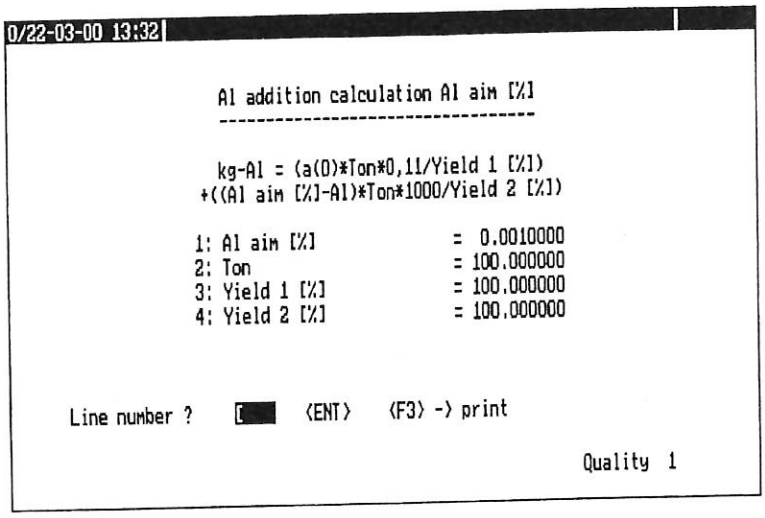
If the oxygen content of the melt is greater than the indicated oxygen aim, the Al addition is calculated with the following formula:



Yield 1: Yield of the added aluminium when steel is still in the oxygen range.

6.3.4.3 Al-addition calculation with Al-aim

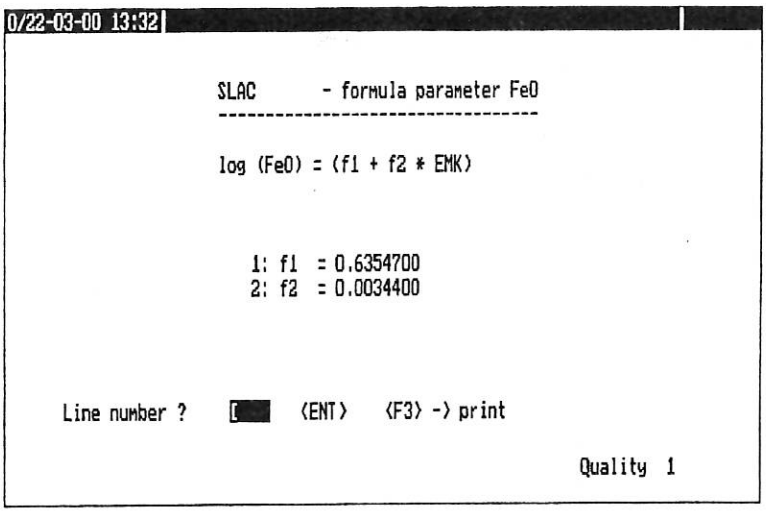
If the Al content of the melt is smaller than the indicated Al aim, the Al addition is calculated with the following formula:



Yield 1 : (see chapter 6.3.4.2)
Yield 2 : Yield of the added aluminium when steel is completely killed and maybe already contains some aluminium in the analysis.

5 SLAC Formula FeO

choice of the point 5 in the menu formulas activates the SLAC formula:



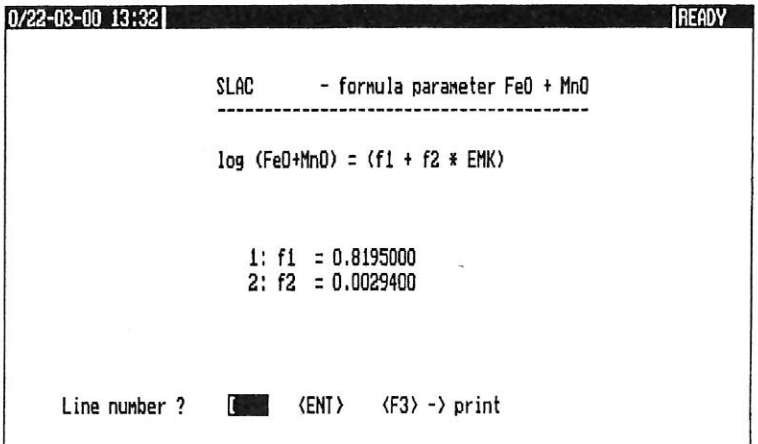
parameters f1 and f2 are adjustable. (defaults f1 = 0,63547 and f2 = 0,00344)

6 SLAC Formula FeO + MnO

same formula is used for the calculation of FeO+MnO (see point 6.3.5), however other meters are entered.
aults f1 = 0,8195 and f2 = 0,00294)

selection of formula is done by choosing the formula at the menu. ((Point 6 in the menu ulas)

ult is : FeO Formula.

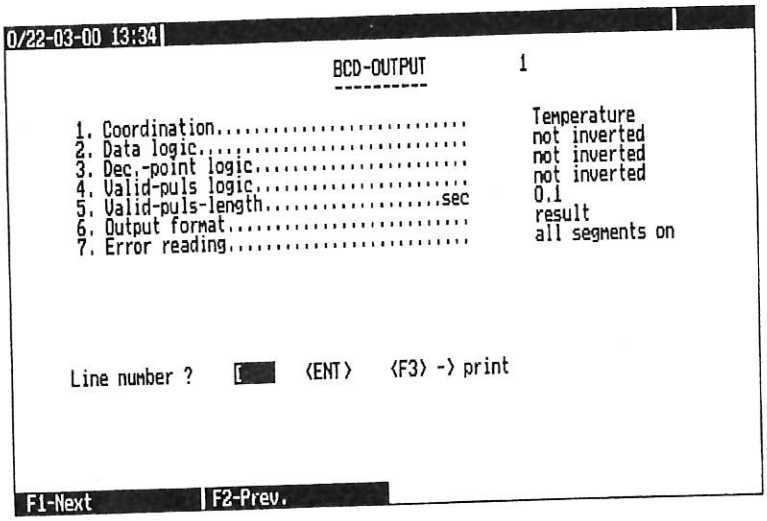


6.4 RS-232 Parameters

The Multi-Lab has two serial RS-232 interfaces both of which are used for the output of the measurement results. The parameters of both interfaces are independently adjustable and can be adapted to special transfer formats. For detailed information, refer section "Serial interface RS-232" in chapter 7.

6.5 BCD Output (optional)

If the BCD output option is available in the Multi-Lab, the output can be set by means of this menu. With key <**F1**> and <**F2**> the output 2 and if installed the outputs 3 and 4 may be chosen.



6.5.1 Co-ordination

This option defines the value which is to appear at the appropriate output I..IV:
temperature [°C/°F], EMF [mV], a(0) [ppm], Al [%], C [%], SLAC (= FeO or FeO + MnO) [%].

6.5.2 Data Logic

The data may be output in inverted or non-inverted form
(non-inverted: BCD-"0" -> all contacts open).

6.5.3 Decimal Point Logic

Non inverted: no decimal point = contact open.

4 Valid Pulse Logic

each measurement a pulse is given to indicate that the data at the output are valid. The pulse also be inverted.

5 Valid Pulse Length

ulse duration can be adjusted in steps of 1/10th of a second.

6 Output Sequence

wing: the output follows the measurement. Every half second a new value is routed to the ut.
applies only to temperature and EMF).

lt: at the output, the result will appear only at the end of asurement and is cleared at the beginning of the next surement.

the result is only valid during the "Data valid pulse", afterwards all contacts are open again.

7 Error Reading

case of an error measurement, all bits are set logically to "1" or "0".

6.6 0/4...20mA-Analogue Output (optional)

If the 0/4...20mA output option is available in the Multi-Lab, this output can be set by means of this menu.

	(standard mA I)	standard mA II)
1. Co-ordination.....	temperature	a(O)
2. Start-value.....	1000	0.000
3. End - value.....	1700	1000
4. Output format.....	memorised	memorised
5. Error reading.....	20mA	20mA
6. Current range.....	0-20mA	0-20mA

Standard values:		
	Temp.:	0 - 20mA = 1000 - 1700 °C
	a(O) :	0 - 20mA = 0.000 - 1000.000 ppm
	C :	0 - 20mA = 0.000 - 100.000
	EMF :	0 - 20mA = -400 - +400 mV
	SLAC :	0 - 20mA = 0.000 - 100.000 %
	Al :	0 - 20mA = 0.000 - 100.000 %

6.6.1 Co-ordination

Both of the outputs can be switched to the different results (see above).

6.6.2 Start-Value

The start and end- value of each result can adapt to the individual requirements. The standard range for temperature is 1000-1700°C.
The settings of the start and end-values are **not** limited and not checked whether they are plausible but end-value has to be greater than the start-value.

6.6.3 End-Value

as above

6.6.4 Output Format

following: the output follows the measurement. Every half second a new value is routed to the output.(this applies only to temperature and EMF).
memorised after meas.: at the output, the result will be stored after the end of a measurement and is cleared at the beginning of the next measurement.

6.6.5 Error Reading

In the case of an error measurement, 0/4mA (according to the switch current range) or 20 mA appears at the output.

6.6.6 Current Range

The current range 0...20mA or 4...20mA is chosen here.

Spool Out of Results

easurements (including error measurements) are stored on the RAM-disk, and the results are ayed in the form of a table. The results of measurement may be displayed with the keys =forward paging or <**F2**>=backward paging.
measurement with the highest line number is the most recent measurement, and number 1 the st measurement. In case of storage overflow, the oldest measurement (number 1) is cleared, he new measurement is added with the highest number.

se of temperature only measurement the result fields of EMF, a(O), %Al and %C are cleared. is easy to differ between Celox and temperature measurements.

ast column shows the isolation values of the temperature and EMF channel in kOhm. The mal value is approx. 200 kOhm.

C measurements are shown in a separate table.

No:	Date:	Time:	Temp:	EMF:	a(O):	% Al:	% C :	Ht-No.:	Place:	ISO T/E
1	29-07-91	11:45	1626.3					1	1	106 201
2	29-07-91	11:45	1590.1					1	1	106 201
3	29-07-91	11:46	1590.0	55.6	1.00	0.000	0.000	1	1	106 201
4	29-07-91	11:46	1589.6					1	1	106 201
5	29-07-91	11:49	1593.6					1	1	106 201
6	29-07-91	11:50	1559.4					1	1	106 201
7	29-07-91	11:52	1573.5	-160.8	1.00	0.024	0.000	1	1	106 201

Displ from line [ ] <ENT>
F1-Next | F2-Prev. | F4-Exit

d the results be printed, the line number of the first and last measurement which should be d are to be fed into the computer.

completion with <ENT> one can choose between output result on the printer or output of the urement points on the serial output.

dialling the output points on the serial output, it is necessary to connect a computer via the interface "ser.-out I" on which the program "MLREC" is running.
PC-program is available on information of instrument and program version number.

menu item: "Output to serial ASCII" is chosen, the measurements selected before are trans- via "ser.-out I" as a text file (ASCII format).

etting of the serial interface is: 9600 baud, 8 Databits, 2 Stopbits, no Paritybit. If the menu "Transfer of measurement samples" in the RS232 menu is switched on, all measurement es will transmit in addition. (see point 7.2.10)

6.8 Hardware Test

(for maintenance only)

⚠ Warning:

When this test is switched on, measurements are not possible.
Signalling is switched to "COMPLETE" and relay contact "complete" is active irrespective of whether a sensor is mounted or not.

6.8.1 Offset voltage

Here the zero of the analogue to digital converter for both input channels is displayed in points.

6.8.2 Reference voltage

Here the reference voltage of the analogue to digital converter for both input channels is displayed in points.

6.8.3 Input

Here the actual input voltage and appropriate temperature in °C for both input channels are displayed.

6.8.4 Cold junction

Here the cold junction (=compensation-) temperature measured at the input plug in °C is displayed.

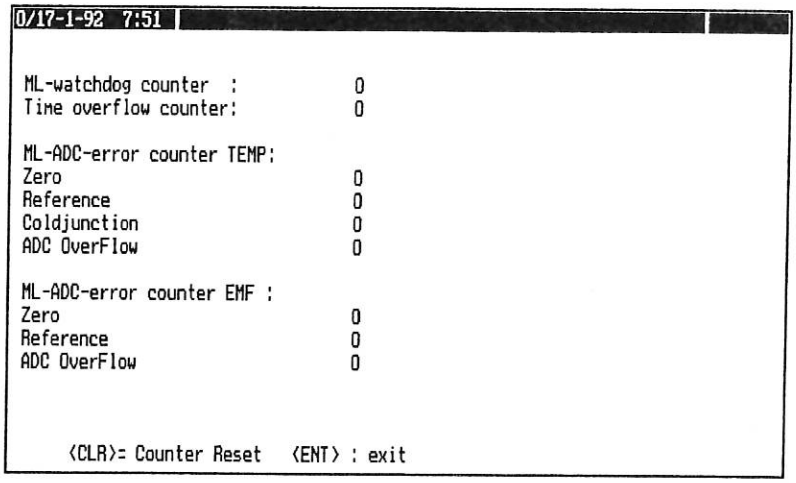
6.8.5 Amplifier calibration

In this menu position three sub menus are selectable where it is possible to add an offset value to the EMF and the temperature channel (connect a stable rated value to the input, correct the displayed value if necessary with key <F1> increase or <F2> decrease). These offset values are stored in an EEPROM on the pre-amp board M-LAB-01.

Sub menu 4 allows an internal amplifier adjustment to be made manually.

6 ADC-Watchdog

values displayed here are test values; with the unit functioning correctly, they must all be zero.



Watchdog counter:
The number of counts shows the number of program resets of the M-Lab board during operation depending on electrical influences (e.g. electrical peaks). This counter is incremented by a status bit which is transmitted from the M-Lab-01 board.

overflow counter:
The M-Lab-01 board interrupt the PC all 100ms, if the PC miss the Interrupt this counter is incremented.

-counter:
If during automatic calibration the measurement of zero or reference failed, the M-Lab-01 board transmitted a status byte which contains this error messages.

Overflow:
The A/D Converter must be ready within a specified time interval, else this error message will be active.

The key <CLR> clears all the counters.

7 BCD Check

the BCD outputs can be tested. The test uses all parameters set before. The program shifts gures 9 to 0 through all five digits. By pushing in one number on the keypad this number is t on all five digits. <ENT> will exit the test program.

6.8.8 0/4...20mA Output Check

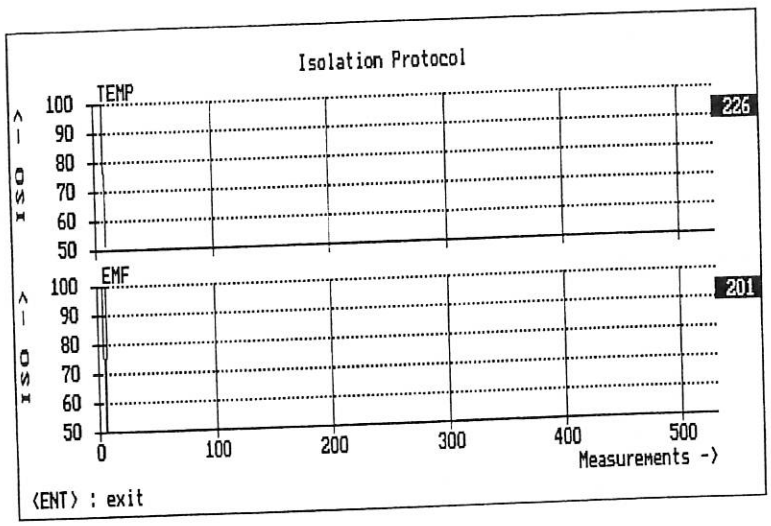
1: mA - Input 0-20 mA
With this point the mA-Output can be tuned between 0 to 20 mA. e.g. Input: 10.00 <**ENT**> = 10mA. The real output value is computed and displayed with three decimals, according to a resolution of 12 bits. (20mA / 4096 = 0,00488mA).

2: Bit-shift-program
The values 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048 are transferred to the D/A Converter value after value, the appropriated current value is displayed.

3: Incremental program
The output value is incremented with a adjustable D/A-value (1 - 4095) at every second. The output value is displayed as current unit.

6.8.9 Isolation Protocol

Before each measurement when the measurement circuit is open an input isolation value of the temperature circuit is determined. When the circuit is closed the isolation value of the EMF circuit is taken. These values are stored with the measurements and shown with this diagram.(0) The value range is < 100kOhm at the temperature channel and < 200kOhm at EMF side. If the isolation is better then these values a line is drawn at the value 100. The momentary measurement value is displayed right beside the diagram with the resistant unit kOhm.



6.8.10 Signal-Check

It is possible to check all signal outputs by using this menu.
If the output READY or MEASUREMENT is active the COMPLETE signal is also active to prevent fail operation.
The signals READY, MESUREMENT, COMPLETE, CELOX, ERROR, HORN and the transmission-complete contact can be switched on and off.

Delete RAM-Disk files

measurements and measurement parameters are stored in a battery-buffered memory; they be recalled until the memory is formatted. The measurement parameters and the output ngs (RS-232, BCD and 0/4...20mA output) however are maintained.

e n t i o n:
tored measurements are cleared after formatting.

0 Bath level (optional, ML-DIST)

optional PC-board ML-DIST determines the duration of distance between lance home position bath level. The bath level is determined with the rapid rise of temperature voltage of a ITHERM temperature sensor type S or type R. With type B the limit switches have to be ged (see 6.10.3 and 6.10.4).
input of the ML-DIST electronic board is connected to the measuring input of the Multi-Lab in llel.
following settings are available for controlling the bath level PC-board:

0.1 Delay after bath level

time of lance movement after reaching bath level.
able from 0 to 5000msec in ms steps.
dard setting: 0 msec

0.2 Bath level valid time

time setting determines how long the found bath level is valid. If the setting is unlimited the level may be erased by switching the input "erase bath-level" or by keyboard command **R><F2>**.
able from 1 to 7200sec and 0 = infinity.
dard setting: infinity

0.3 Temperature maximum

parameter determines the temperature where the contact
level" and "bath level delayed" = "lance stop" are closed, if no bath level had been found e.
ble from "temp. minimum" to "temp. start value" [K].
dard setting: 1273 K should be set to **673 K** with type B.

0.4 Temperature minimum

parameter determines the temperature where the measurement starts. If the measured value her than or equal to the initial temperature setting, then the detection of bath level sequence is ed.
ble from 273K to "temperature maximum" [K].
dard setting: 573 K should be set to **373 K** with type B.

6.10.5 Sensitivity

This parameter sets the required rise of temperature to find the bath level. Smaller value means higher sensitivity.
Settable from 5 to 255 K/10ms.
Standard setting: 10 K/10ms

6.10.6 Lance drive control

internal: The lance movement is controlled by the contacts: "lance fast", "lance slow" and "lance back". The lance movement can be started with the keyboard command <CLR><F1>, or electrical with the start input command, if the lance is in home position, and the measurement unit is in READY position. When the lance leaves the home position the detection of bath level starts.(Input "Home position" = 0V or contact open)
external: The detection of bath level is started with leaving the home position contact. A start command is not used.
Settable internal / external
Standard setting: internal

6.10.7 Input contact: Home position

contact: The contact is used to start the detection of bath level.

no contact: Detection of bath level is started with the signal "READY". The contact "bath level" closes with reaching bath level and resets with a new signal "READY".
Settable contact / no contact
Standard setting: no contact

6.10.8 Input contact: Lance moves down

contact: The contact is an additional use to start the detection of bath level.

no contact: The start of bath level detection is only controlled by the contact "Lance in home position".
Settable contact / no contact
Standard setting: no contact

6.10.9 Move to bath level connected with READY Signal

ON: Lance can only move to measured bath level, when Multi Lab is in "READY" position. This demands samplers with built-in contact block.
Off: Function is switched off. Lance move to bath level is allowed at all times.
Settable ON / OFF
Standard setting: Off

6.10.10 Output switch logic inverted

ON: Contact logic of all output relays is inverted, for example: bath level detected: contact open
Settable ON / OFF
Standard setting: OFF

cription of lance move control:

rolling of lance movement via ML-DIST board
e control internal)
e are three relay outputs to control lance movement (lance fast, lance slow and lance back).
ce is at home position and Multi-Lab is ready for measurement, it is possible to start lance
ement via input signal "start" or keyboard control <CLR><F1>. (contact "lance fast" closed).
starts bath level detection or movement to bath level and bath level delay time, depending on
ous measurement condition.
s line on screen shows:
level: searching lance: down or
level: 21234 ms lance: down.

of bath level detection or movement to bath level.
e control external)
IST board is not involved with controlling lance movement.
control inputs are provided for this kind of external controlling (home position and lance move
). The start of bath level detection depends on both contacts. If "lance is in home position"
ignal "lance down" is active the measurement is started with leaving the home position
ct.

to detect bath level:

bath level" contact is closed, when the sensor is immersed into the melt and temperature
over set sensitivity (sensitivity 5-255 K/10ms) or when the "max temp"-value is reached or
he "MEASUREMENT"-signal.
e contact fast" opens and "lance contact slow" closes.
s line shows: *lance: measure.* This starts the selected bath level delay time. After this time
ntact "bath level delayed" = "lance stop" closes and lance slow open.
e contact "lance back" closes with the signal "MEASUREMENT COMPLETE".

bath level:

ath level is erased when the external signal (Erase bath level) is active or the keypad
nand <CLR><F2> or the selected bath level hold time is reached.
s line shows: *bath level: cleared*
ng: If the lance is in home position and bath level has been found before the meaning of
travel changes from "move to bath level" to "searching for bath level".

Output functions:

Bath-level:
Contact is active when a bath level was found.
Contact continuous closed until:

a) new "READY"-signal (without "home position"-signal contact),
b) bath level valid time is reached,
c) control input "erase bath level" is active or
d) keypad command <CLR><F2>

Bath-level delayed = lance stop:
This contact should be used to stop the lance.
It closes after the selected delay time. It opens with lance home position or when the bathlevel contact is erased. When the bathlevel was detected at the "max. temp." or with the "MEASUREMENT" - signal the delay time is interrupted immediately.

Lance fast:
With selected lance control this contact closes with start command. It opens with bath level detected.

Lance slow:
This contact closes with detection of bath level. It opens after overflow of bath level delay time.

Lance back:
This contact closes with the Multi-Lab signal "MEASUREMENT COMPLETE" or the external input "emergency return" until lance reaches home position.

Input functions:

Functions are active when 24V DC is switched to input or external contact is closed (see technical appendix).

Lance home position: Lance is in at home position.

Lance move down: Lance moves to bath.

Erase bath-level:
Detected bath level is erased in memory. Next measurement is a detection of bath level.

Start:
Lance travel is started.

Emergency return:
Lance moves immediately back to start position. Contact "lance back" and "bath level delayed" = "lance stop" are closed until lance reaches home position.
Contact "bath level" is not involved.

nples for Bath Level Setting

The BL-Board (bath level board) delivers the output contacts "bath level found" and "bath level delayed" = "lance stop" without connection from external contacts.

g:

Control of the lance drive	intern or extern
Lance contact lance in home position	no contact
Lance contact lance drives downwards	no contact
Drive on bath level together with "READY"	OFF

s setting a found bath level is automatically erased when a new "READY" signal appears (if a robe is connected to the lance).

On the BL-Board a contact "lance in home position" is connected. When sampling one should drive only with "READY" on the found bath level position. A start command is not necessary. The contact "bath level delay" = "lance stop" should be set 1 s after bath level is found.

g:

Delay after bath level	1000
Bath level memory duration	infinite
Control of the lance drive	extern
Lance contact lance in home position	contact
Lance contact lance drives downwards	no contact
Drive on bath level together with "READY"	ON

ath level must be erased before starting a new charge by <CLR><F2> or input "erase bath on 24V.

The BL-Board should take over the control of the lance drive.

g:

Delay after bath level	1000
Bath level memory duration	infinite
Control of the lance drive	intern
Lance contact lance in home position	contact
Lance contact lance drives downwards	no contact
Drive on bath level together with "READY"	ON

nce drive starts when the following conditions are fulfilled:
in home position "READY" signal (measurement circuit closed) and start command nitted to the board (<CLR><F1> or start contact on 24 V).
ath level must be erased before starting a new charge.

The BL-Board should take over the control of the lance drive. The bath level should automatically deleted after 10 minutes. Besides, the measurement is interlocked with the additional contact "lance drives downwards".

g:

Delay after bath level	1000
Bath level memory duration	600
Control of the lance drive	intern
Lance contact lance in home position	contact
Lance contact lance drives downwards	contact
Drive on bath level together with "READY"	ON

7 RS-232 Interface

7.1 Hardware

The integrated RS-232 interface operates the signals TxD (Transmit Data), CTS (Clear to Send) and RxD (Receive Data). These signals are made available by the AT-computer board with V 24 level. Via the integrated M-LAB-CL board, these signals are converted also for the 20mA current loop and output, galvanically separated via opto-couplers.

The 25 pin sub-D flange socket at the rear panel is defined as follows:

V24:		20mA:	(Standard) active	passive
1	Screen	9	CTS +	-
2	TxD	10	RxD -	+
3	RxD	11	CTS -	+
4	RTS	12	RxD +	-
5	CTS	18	TxD -	+
6	DSR	25	TxD +	-
7	GND = Signal Ground			
8	DCD			
20	DTR			

7.2 Configuration

The settings are stored and reset when the instrument is switched on. The following pre-settings are applicable when the RAM-disk was formatted or the standard process parameters were loaded:

	(Standard Ser. I)	(Standard Ser. II)
1. Baudrate.....	9600	300
2. Databits.....	8	7
3. Stopbits.....	1	2
4. Parity.....	Even parity	Even parity
5. Protocol.....	3964R with BCC	No protocol
6. CTS-control (busy/ready).....	Off	Off
7. Datatelegrams.....	STX<->ETX	Deltaprint
8. Decimal.....	point	comma
9. Programming Datatelegram.....		
10.Transfer of measurement samples	Off	Off
11.Time with seconds.....	Off	Off
12.Teleheader Destination No. .... (only with Datatelegram "Teleheader")	180 = B4H	

following interface configuration can be realised via the RS-232 parameter menu:

.1 Baud Rate

150, 300, 600, 1200, 2400, 4800, and 9600 baud

2 Data Bits

8 data bits

3 Stop Bits

2 stop bits

4 Parity Bit

, odd, no parity

5 Protocol

-Lab can be set on different transmission procedures.

rotocol (unsolicited output, CTS-control out)
After completion of measurement the data is transmitted directly.

(Data output with CTS-control on (Busy/Ready)
After completion of measurement the data is transmitted directly, whereby the receiver can hold the data transmission via his RTS-line
(20 mA = Ready, 0mA = Busy = send no data).
A started line is then uninfluenced and completely transmitted and not repeated.

mission protocol 3964R and 3964R BCC

receiver has a transmission protocol 3964R, then this protocol can be set. The Multi-Lab mits after each measurement the request (STX) to the receiver. When the receiver owledges this request (DLE) the transmission begins. The data are then transmitted in a block then ends with control character (ETX).
lock can be repeated three times, when the transmission was not positively acknowledged he receiver (e.g. NAK or time overflow).
lock protection can be done with a block summation sign (BCC); (setting: 3964R with BCC).
measurement overwrites the values which till then have not been transmitted in the serial buffer.

ollowing interface configuration can be realised via the RS-232 parameter menu:

1 Baud Rate

150, 300, 600, 1200, 2400, 4800, and 9600 baud

2 Data Bits

data bits

3 Stop Bits

stop bits

4 Parity Bit

odd, no parity

5 Protocol

Lab can be set on different transmission procedures.

otocol (unsolicited output, CTS-control out)
After completion of measurement the data is transmitted directly.

(Data output with CTS-control on (Busy/Ready)
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measurement overwrites the values which till then have not been transmitted in the serial buffer.

7.2.5.1 Data Transfer Procedure 3964R

Data transfer between the Multi-Lab and the process computer is carried out in three phases:

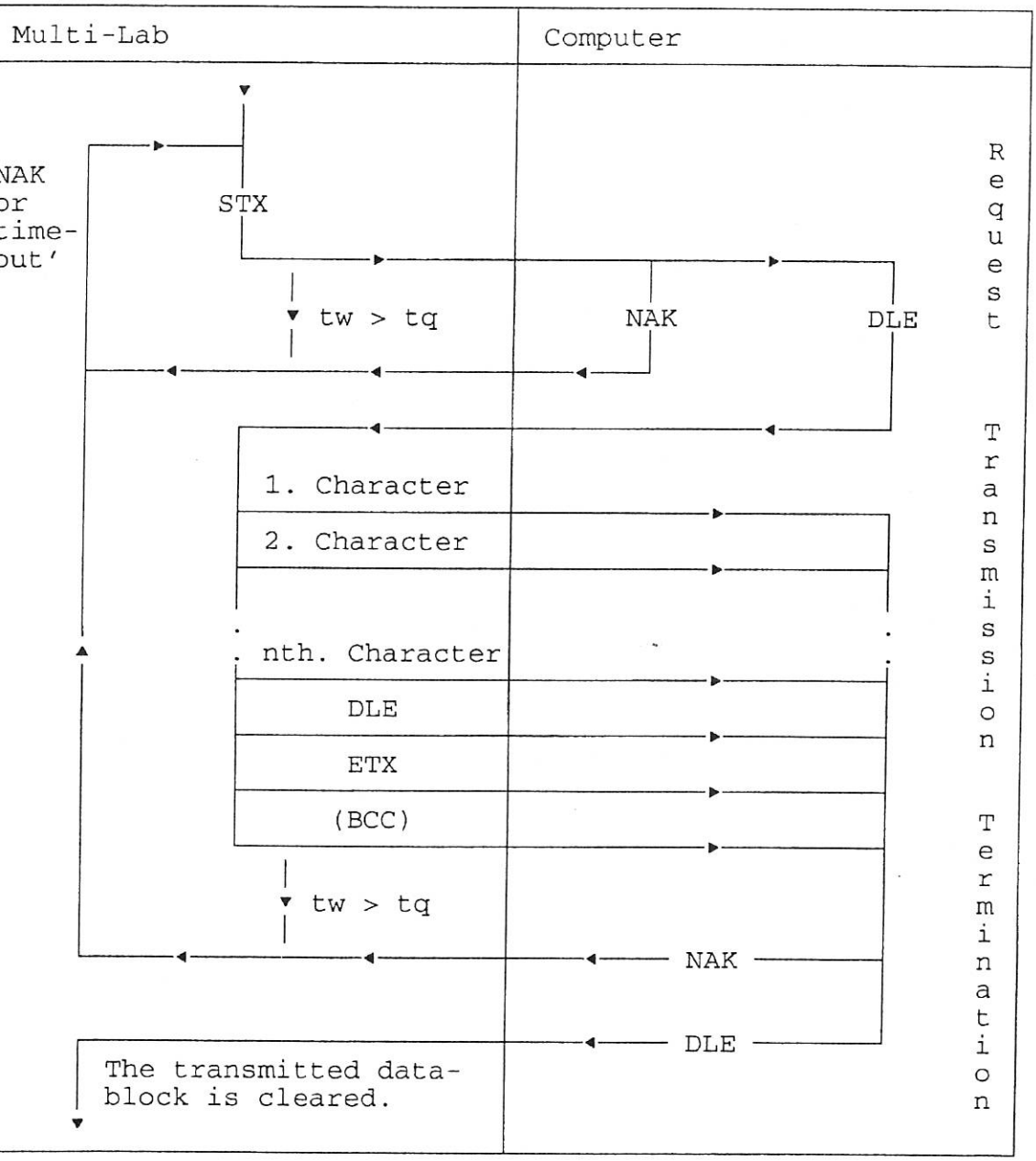
1. Connection set up
2. Data transfer
3. Connection termination

In the data transfer mode, the Multi-Lab has to be considered the MASTER and the process computer the SLAVE. To initiate a data transfer routine, the Multi-Lab sends the <STX> control character to the process computer. Then the Multi-Lab expects a positive confirmation from the process computer (control character <DLE>) to start the data transfer. Receipt of confirmation is monitored with the time step tq. If within this period of time a positive confirmation is not received, or if the Multi-Lab receives a negative response (control character <NAK>, it tries after the period tq to reinitiate the data transfer process. This procedure is repeated till the process computer has sent a positive <DLE> confirmation (within the time tq) to the Multi-Lab. After receipt of <DLE> the Multi-Lab starts the transfer of the measured data to the process computer.

The end of the data block is characterised by the Multi-Lab by the two control characters <DLE><EXT>. If in the menu, a block check character BCC has been selected for the serial interface, the character follows <EXT>.

Subsequently the Multi-Lab waits for the confirmation from the process computer. If within the confirmation monitoring period tq the positive confirmation <DLE> has been received, the Multi-Lab concludes the data block and cancels it. If however, a negative confirmation <NAK> is received within the time tq, or if there is no confirmation whatsoever, the Multi-Lab terminates the transfer and tries again to initiate the data transfer process.

If a data block cannot be correctly transmitted after three trials (repeat counter), the block is concluded and cancelled. Then the system continues with the next data block (if existing).



5.2 Character Frame and Datatelegram

character frame (number of data bits, parity, number of stop bits), the data transfer rate ..9600 Baud) and the datatelegram can be set via the screen menus, as described above.

5.3 Data Transfer Security

from the parity bit, a block check character can be transferred at the end as an additional fer check. This block check character contains the length parity of the data block transmitted. block checking, all characters of the block are covered, with the exception of the control acter <STX>. The method for the determination of BCC corresponds with the exclusive "OR" of

5.6 Control Characters used

data output of the Multi-Lab is code-independent (transparent) in the ISO 7 bit code. Only the rol characters or combinations of control characters shown in the following list are relevant for transfer. All the other control characters are not processed.

ontrol haracter	Hexa-decimal	Meaning of Control Characters During Data Transmission
TX	02	marks the request of a connection from Multi-Lab to process calculator, as data are ready for transmission. A receipt will be expected within receipt period.
LE	10	control character <DLE> will signalise Multi-Lab after <STX> request that the counter station is ready to receive the data from Multi-Lab. (pos. acknowledgement of the transmission request) (after <DLE><ETX>(BCC) the counter station will confirm that the data have been received correctly (pos. receipt of the data transmission). In both cases the control character must be received within the receipt control period tq.
AK	15	the counter station will communicate to Multi-Lab after a <STX> with control character <NAK> that it is not ready to receive. If after a <STX> the sending of <NAK> does not occur, Multi-Lab will automatically try to again build up the connection after the control period tq is over. (after the datablock has been received control character <DLE> <ETX>(BCC) the counter station will let Multi-Lab know via <NAK> that there is a fault in transmission. If there is no negative receipt, Multi-Lab will wait until the expiration of the control period and it will then interpret the non-arrival as a negative receipt (please note repetition counter)
LE ETX	10 03	thus Multi-Lab marks the end of a transmission block. The block control character (BCC) will (poss.) follow. If further data blocks are available, these will be activated only after a positive receipt <DLE> or after three transmissions with neg. receipt (see <NAK>); a new connection will be build up again with <STX>

7.2.5.7 Fault Treatment of Transfer Protocol

Initiating conflict

The standard coupling procedure (according to Siemens 3964R) also includes the establishment of a connection to the process computer (=coupling partner). Since both can establish a connection at any time there may be an initiating conflict. To overcome such a conflict, priorities are assigned to the coupling partners. The computer with the higher priority has to ignore the request. Since the Multi-Lab cannot receive any data blocks from the coupling partner, it is set to high priorities and expects from the process computer a positive or negative confirmation of requests. All other incoming characters are ignored until receipt of the confirmation (or time-out).

Other transfer faults

Apart from the initiating conflict, there may be further faults during data transfer:

1. Faulty response to procedure set-up
2. Faulty response to procedure conclusion
3. Receipt of a character during data transfer

If faulty characters or characters that are non valid for the protocol are received during waiting for the confirmation (connection set-up and termination), then these characters will be ignored. There is no special treatment of faulty or irrelevant characters. With missing confirmation, procedure restart is initiated at the end of the monitoring period concerned. The characters received by the Multi-Lab during data transfer to the process computer are also ignored.

7.2.5.8 3964R and 3964R BCC RT

(with reaction-telegram)

At the end of transmission the receiver answered with a reaction telegram. The Multi-Lab answered to place the right connection. The received data of these telegram has no influence to Multi-Lab.

7.2.6 CTS Control (busy / ready)

The CTS control allows the control of the data flow from the interface to the receiver, or switching off this control function. The receiver can interrupt the data flow via the RTS line if this control function is active (busy / ready control).

busy = receiver not ready for data reception = 0mA
ready = receiver ready for data reception = 20mA

Once started a character is completely transferred and not repeated.

7 Data Telegrams

this option, one of the four available data output formats of the interface can be set:

7.1 One Row STX <--> ETX

ut in a single line, always the same telegram length:

```
------------------------ HEX ----------------------   ----- ASCII ----
  02 44 41 54  45 20 3A 20   31 32 2E 30  31 2E 30 31   .DATE : 12.01.01
  20 54 49 4D  45 20 3A 20   31 31 2E 33  33 20 50 4C    TIME : 11.33 PL
  41 43 45 3A  20 30 31 20   48 54 2D 4E  4F 3A 20 30   ACE: 01 HT-NO: 0
  30 30 30 30  30 30 31 20   54 45 4D 50  20 3A 20 31   0000001 TEMP : 1
  36 35 31 2E  37 20 43 20   45 4D 46 20  20 3A 20 2D   651.7 C EMF  : -
  31 31 39 2E  35 20 6D 56   20 41 28 4F  29 20 3A 20   119.5 mV A(O) :
  30 39 2E 32  32 20 70 70   6D 20 41 4C  20 20 20 3A   09.22 ppm AL   :
  20 30 2E 30  31 30 20 25   20 43 41 52  42 20 3A 20    0.010 % CARB :
  30 2E 30 30  30 20 25 20   53 4C 41 43  20 3A 20 30   0.000 % SLAC : 0
  30 2E 30 30  20 25 0D 0A   03                        0.00 %...
```

X>DATE : TT.MM.JJ TIME : HH.MM PLACE: xx HT-NO: xxxxxxxx TEMP :
.x C EMF : ±xxx.x mV A(O) : xx.xx ppm AL : x.xxx % CARB : x.xxx %
C : xx.xx % <CR><LF><ETX>

an error reading the corresponding values are transmitted as "F" e.g.: Temp : FFFF.F

an "Only"-temperature measurement the values for EMF, a(O), CARB, AL and SLAC are all zero, e.g.: AL : 0.000

a SLAC measurement the values for TEMP, a(O), CARB and AL are all set to zero,
AL : 0.000

alue SLAC depends on setting in the formula parameters either the value FeO or FeO+MnO.

data telegram is recommended in connection with a process computer.

7.2.7.2 Printer

Output to serial Multi-Lab printer

```
No. ------------------------ HEX ----------------------   ----- ASCII ----
0000  44 41 54 45  20 3A 20 31   32 2E 30 31  2E 30 31 0D   DATE : 12.01.01.
0010  0A 54 49 4D  45 20 3A 20   31 31 2E 33  30 0D 0A 50   .TIME : 11.30..P
0020  4C 41 43 45  3A 20 30 31   0D 0A 48 54  2D 4E 4F 3A   LACE: 01..HT-NO:
0030  20 30 30 30  30 30 30 30   31 0D 0A 54  45 4D 50 20    00000001..TEMP
0040  3A 20 31 36  35 31 2E 37   20 43 0D 0A  45 4D 46 20   : 1651.7 C..EMF
0050  20 3A 20 2D  31 31 39 2E   35 20 6D 56  0D 0A 41 28    : -119.5 mV..A(
0060  4F 29 20 3A  20 30 39 2E   32 32 20 70  70 6D 0D 0A   O) : 09.22 ppm..
0070  41 4C 20 20  20 3A 20 30   2E 30 31 30  20 25 0D 0A   AL    : 0.010 %..
0080  43 41 52 42  20 3A 20 30   2E 30 30 30  20 25 0D 0A   CARB : 0.000 %..
0090  53 4C 41 43  20 3A 20 30   30 2E 30 30  20 25 0D 0A   SLAC : 00.00 %..
```

```
DATE : xx.xx.xx CR LF      ( e.g.: 31.12.99 )
TIME : xx.xx CR LF         ( e.g.: 23.59 )
PLACE: xx CR LF            (  1  to  99 )
HT-NO: xxxxxxxx CR LF      (  1  to  99999999 )
TEMP : xxxx.x C CR LF      ( e.g.: 1687.4 C  or 3069.3 F )
EMF  : ±xxx.x mV CR LF     ( e.g.: -127.9  or  209.5 )
A(O) : xx.xx ppm CR LF     ( 0.001 to 99999  with floating point )
AL   : x.xxx % CR LF       ( 0.001 to 9.999 )
CARB : x.xxx % CR LF       ( 0.001 to 9.999 )
SLAC : xxx.x % CR LF       ( 0.1 to 100.0 )
```

7.2.7.3 Short Telegram

Output in a single line, always the same telegram length, with block check character BCC:

```
No. ------------------------ HEX ----------------------   ----- ASCII ----
0000  02 0A 30 20  31 36 35 31   20 2D 31 31  39 20 30 30   ..0 1651 -119 00
0010  30 39 2E 32  32 20 30 2E   30 31 30 20  30 30 2E 30   09.22 0.010 00.0
0020  30 20 30 31  20 30 20 30   30 0D 30 35  35 03         0 01 0 00.055.
```

```
STX LF 0 xxxx ±xxx xxxx.xx x.xxx xx.xx xx 0 00 CR xxx ETX
       ↑ ↑    ↑   ↑       ↑     ↑     ↑          ↑
       | Temp. EMF a(O) Al or.C  SLAC  place      BCC
       identifier, fix
```

BCC= block check character: XOR of all characters between STX and ETX (except BCC), BCC is carried out in Decimal ASCII format (000 to 255).

.7.4 Deltaprint

telegram is special made for the Heraeus Electro-Nite printer Deltaprint:

```
------------------------ HEX ----------------------   ----- ASCII ----
0  7F 7F 7F 7F  7F 7F 7F 7F   7F 7F 7F 7F  7F 7F 7F 0F   ................
0  2A 2A 2A 2A  2A 2A 2A 2A   2A 2A 2A 2A  2A 2A 2A 53   **************S
0  4C 41 43 20  3A 20 30 30   2E 30 30 25  0D 43 41 52   LAC : 00.00%.CAR
0  42 20 3A 20  30 2E 30 30   30 25 0D 41  4C 20 20 20   B : 0.000%.AL
0  3A 20 30 2E  30 31 30 25   0D 41 28 4F  29 20 3A 20   : 0.010%.A(O) :
0  30 39 2E 32  32 70 70 6D   0D 45 4D 46  20 20 3A 20   09.22ppm.EMF  :
0  2D 31 31 39  20 6D 56 0D   54 45 4D 50  20 3A 20 31   -119 mV.TEMP : 1
0  36 35 31 20  43 0D 48 54   2D 4E 4F 3A  20 31 0D 50   651 C.HT-NO: 1.P
0  4C 41 43 45  3A 20 31 0D   54 49 4D 45  20 3A 20 31   LACE: 1.TIME : 1
   31 2E 33 31  0D 44 41 54   45 20 3A 20  31 32 2E 30   1.31.DATE : 12.0
   31 2E 30 31  0D                                      1.01.
```

following printout appears on the printer:

ox measurement:
E : 20.12.98
E : 15.46
CE: 3
NO: 76894351
P : 1623 C
  : -127 mV
  : 06.80ppm
  : 0.011%
B : 0.000%
C : 0000 %
****

Temp. measurement:
DATE : 03.01.99
TIME : 08.56
PLACE: 19
HT-NO: 1
TEMP : 1598 C
EMF : 0000 mV
A(O) : 0000 ppm
AL   : 0000 %
CARB : 0.000 %
SLAC : 0000 %
****

Celox error meas.:
DATE : 14.01.99
TIME : 18.00
PLACE: 1
HT-NO: 573
TEMP : FFFF C
EMF : FFFF mV
A(O) : FFFF ppm
AL   : FFFF %
CARB : 0.000 %
SLAC : 0000 %
****

ox measurement:
E : 20.12.98
E : 15.52
CE: 5
NO: 4852
P : 1730 C
  : +194 mV
  : 1316 ppm
  : 0.011%
  : 0.023%
  : 0000 %
****

Temp. error meas.:
DATE : 03.01.99
TIME : 14.36
PLACE: 12
HT-NO: 178
TEMP : FFFF C
EMF : 0000 mV
A(O) : 0000 ppm
AL   : 0000 %
CARB : 0000 %
SLAC : 0000 %
****

Celox error meas.:
DATE : 14.01.99
TIME : 18.23
PLACE: 10
HT-NO: 12345678
TEMP : 1598 C
EMF : FFFF mV
A(O) : FFFF ppm
AL   : FFFF %
CARB : FFFF %
SLAC : 0000 %
****

7.2.7.5 Teleheader

The datatelegram "Teleheader" can be chosen for the transmission procedure "3964 R" if a header is used as a telegram identifier e.g. in the Siemens computer link RK 512. Byte 5 contains the selectable destination address in the SIMATIC. Byte 7 and 8 contain the number of information data to be transferred in words (double bytes). All other bytes 1...10 are fix.

Byte	Meaning	Character	HEX	
1	Tel.-Identifier	<NULL>	00h	
2	Tel.- Identifier	<NULL>	00h	
3	Command "SEND"	'A'	41h	
4	Type "Data block"	'D'	44h	
5	Destination address		B4h	selectable 0-FFh
6	Data word DW	<SOH>	01h	
7	No. of data (High)	<NULL>	00h	
8	No. of data (Low)	'4'	34h	52 data words = double bytes
9	no CF		FFh	
10	all CPU's		FFh	

```
DA 28.04.99 TI 13.39 CH 01 HT 00000001 TE 1645.2 EM +000.0 AO 00.00 TL 1492.3 CA
0.484 AL 0.000 SL 00.00

No. ------------------------- HEX ----------------------   ----- ASCII ----
0000  00 00 41 44  00 01 00 34   FF FF 44 41  20 32 39 2E   ..AD...4..DA 29.
0010  30 34 2E 39  39 20 54 49   20 31 33 2E  33 39 20 43   04.99 TI 13.39 C
0020  48 20 30 31  20 48 54 20   30 30 30 30  30 30 30 31   H 01 HT 00000001
0030  20 54 45 20  31 36 34 35   2E 32 20 45  4D 20 2B 30    TE 1645.2 EM +0
0040  30 30 2E 30  20 41 4F 20   30 30 2E 30  30 20 54 4C   00.0 AO 00.00 TL
0050  20 31 34 39  32 2E 33 20   43 41 20 30  2E 34 38 34    1492.3 CA 0.484
0060  20 41 4C 20  30 2E 30 30   30 20 54 4C  20 30 30 2E    AL 0.000 SL 00.
0070  30 30                                                 00
```

DA = Date, TI = Time, CH = Channel, HT = Heat-No, TE = Temperature, EM = EMF, AO = a(O), CA = Carbon, AL = Aluminium, SL = SLAC (FeO or FeO+MnO)

ASCII-code	hexadecimal	explanation
STX	02	Start of text
ETX	03	End of text
ACK	06	Acknowledge
LF	0A	Line feed
CR	0D	Carriage return
DLE	10	Data link escape
NAK	15	negative acknowledge

.6 Programmable Data telegram

s the data telegram programmed before. (for details see 7.2.9)

.7 Integer Format

all results in the binary integer format: DDMMYYHHIISSPPNNTTEEAALLCCFF = 28 bytes

= day	MM	= month
= year	HH	= hour
= minute	SS	= second
= place	NN	= heat number
= temperature [°C]*10	EE	= EMF [mV]* 10
= a(O) [ppm]* 10	LL	= Alu [%] *1000
= C [%] * 1000	FF	= FeO or MnO [%]* 10

letter stands for a transferred byte. (Order: Low byte, high byte)

7.2.7.8 Par → Ser Serial Printer

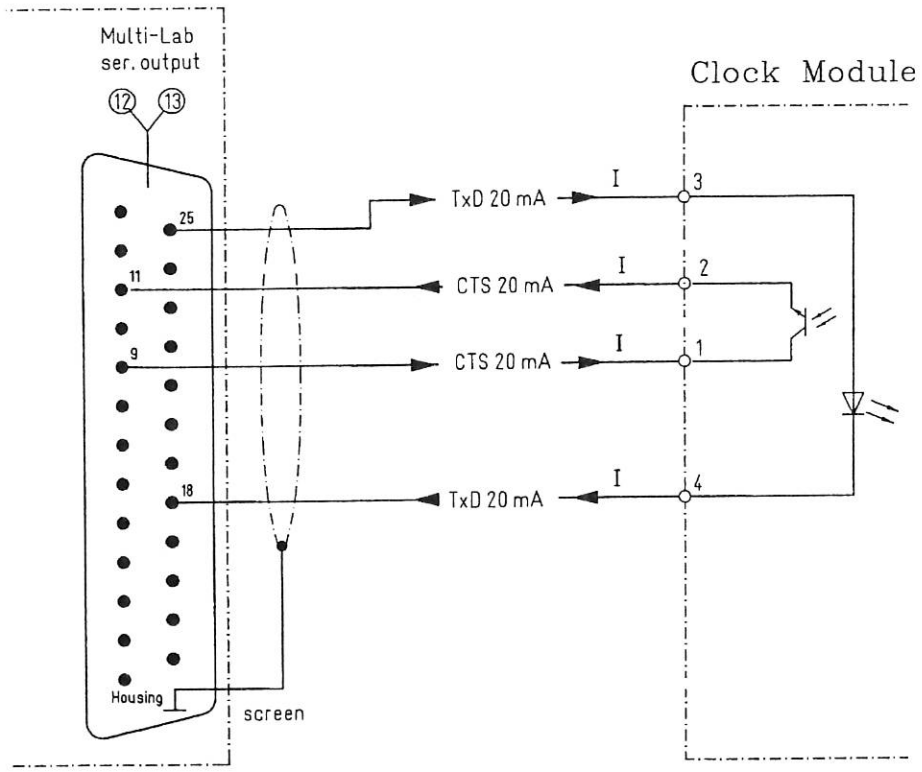
Connection with 20 mA TTY - Current Loop

It is possible to switch over the data string from the Centronics Interface (connection of the parallel printer) to one with a serial interface for long distance transmission. The parallel printer can be upgraded with a serial interface called Clock Module. With this interface it is possible to work with a 20mA current loop (Multi-Lab output Ser. I or Ser. II). It is important to configure both units in the right way to achieve a problem free data transmission. Therefore the point "data telegram" has to be set to **Par-->Ser**. If selected **baudrates** have a higher transmission rate than the print speed the **CTS-control** of the Clock Module and the **Multi-Lab** must be activated. Please see the manual Clock Module. The serial port of **Multi-Lab** is then initialised like the pre-set parameters:

baudrate	:	2400
databits	:	8
stopbits	:	2
parity	:	NONE
protocol	:	NO PROTOCOL
CTS	:	ON
datatelegram	:	PAR-->SER

The configuration of the Clock Module has to be set as follows:

baudrate	:	2400
databits	:	8
parity	:	OFF



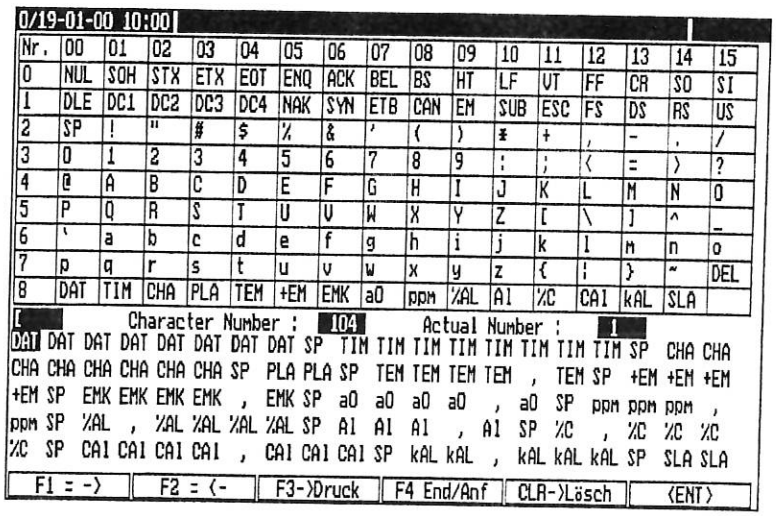
7.2.8 Decimal

The decimal sign for the serial data telegrams can be set as point or comma.

.9 Programmable Data telegram (description)

ıser data telegram can build by this menu point. Both serial communication ports
1 and Ser 2) can use its own telegram. The data telegram includes 500 characters maximum.

selection of menu point 9, the following picture appears on the screen. The upper part of this
e shows all selectable characters and results of the Multi-Lab in the form of a matrix.
w there are some fields showing information of the data telegram as the actual input number,
ength of data telegram and the actual cursor position. The following 5 lines shows a share of
rammed telegram. The last line shows the meaning of function keys.



0/19-01-00 10:00																
Nr.	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	DS	RS	US
2	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	¦	}	~	DEL
8	DAT	TIM	CHA	PLA	TEM	+EM	EMK	aO	ppm	%AL	Al	%C	CAl	kAL	SLA	

1 Character Number : 104 Actual Number : 1

DAT DAT DAT DAT DAT DAT DAT DAT SP TIM TIM TIM TIM TIM TIM TIM TIM SP CHA CHA
CHA CHA CHA CHA CHA CHA CHA SP PLA PLA SP TEM TEM TEM TEM , TEM SP +EM +EM +EM
+EM SP EMK EMK EMK EMK , EMK SP aO aO aO aO , aO SP ppm ppm ppm ,
ppm SP %AL , %AL %AL %AL %AL SP Al Al Al , Al SP %C , %C %C %C
%C SP CAl CAl CAl CAl , CAl CAl CAl SP kAL kAL , kAL kAL kAL SP SLA SLA

F1 = -> | F2 = <- | F3->Druck | F4 End/Anf | CLR->Lösch | <ENT>

ription of function keys:

shift cursor to next right character or result.
shift cursor to next left character or result.
print data telegram.
move cursor to beginning or end of telegram.
delete one character or result at cursor position.

Character or result input

A character or result is added to the telegram by input a three number key command of the character table (first: line no. 0-8, second: row no. 00-15) and the key <ENT>.
Example: the control sign "STX" corresponds to number 002 and the character "T" to number 504. After numerical input and confirmation with <ENT> the corresponding character is added at cursor position. An additional **<ENT>** command leaves the menu and stores the data telegram, when it is pushed without numerical input. A result is added to the telegram with the corresponding number and an additional input of result length including comma and length of decimals. The result term is displayed at the data telegram with all places and position of comma.

The result and measurement values are shown at the following table:

short name	term	no.
DAT	date	800
TIM	time	801
CHA	heat number	802
PLA	place number or corresponding text to place (1..19)	803
TEM	temperature plateau value	804
+EM	EMF-value with sign 4 digit without decimals	805
EMK	EMF plateau value	806
a(O)	oxygen activity	807
ppm	oxygen activity (floating point)	808
%Al	Al value in %	809
Al	Al-value in % * 10^{-3}	810
%C	carbon value in %	811
CAl	carbon or Al-value	812
kAL	Al tab calculation	813
SLA	FeO or FeO+MnO result after a SLAC measurement	814

.10 Transfer of all measurement samples

CII/Integer format)

menu item "Transfer of measurement samples" in the menu RS232 parameters means that the al data telegram can extend by all single measuring points of the measurement. The data will ransferred after each measurement as follows:

MMM><SP><AAAA><SP><BBBB><CR><TTTT,T><SP><VEEE,E>
>...<TTTT,T><SP><VEEE,E><CR>

interval between two measurement samples is 100 milliseconds (= 10 samples/s).

MM	number of measurement samples (both temperature and EMF)
A	event of temperature result (* 1/10 sec from the first sample)
B	event of EMF result
T,T	temperature
	+/-
E	EMF
	carriage return (0DH)
	space (20H)

wing settings have to select in the serial parameters:

7. Datatelegram ..... STX<-->ETX

10. Transfer of measurement samples ..... ASCII

a measurement the data message with all measuring and calculation values is transmitted ccording to point 7.2.7.1 but without ETX. Immediately after this all single measured samples scribed above are transmitted, as last character the still missing ETX.

menu item is switched to "integer format", all of the above indicated data will be sent in an r binary format. The temperature and EMF results are then multiplied by 10.

1 Time with seconds

menu item is switched to on, the time of measurement is extended by seconds in **all** data ams (instead 10.15 10.15.59 → **all** datatelegrams are three characters longer !).

2 STX <--> ETX Heat Number Input via RS232

ssible to set the Heat Number via serial Interface RS232. It is recommended to set the te, and to choose the same dataformat at the sender and the Multi-Lab.
lowing parameters have to set:

:	STX--ETX
l:	No Protocol
ontrol:	Off

8 Important Installation remarks

To guarantee the mode of security of the Multi-Lab instruments in all working condition and combined with other instruments like, data printer, digital display or computer, following instructions have to be observed absolutely.

1. Serial Interface

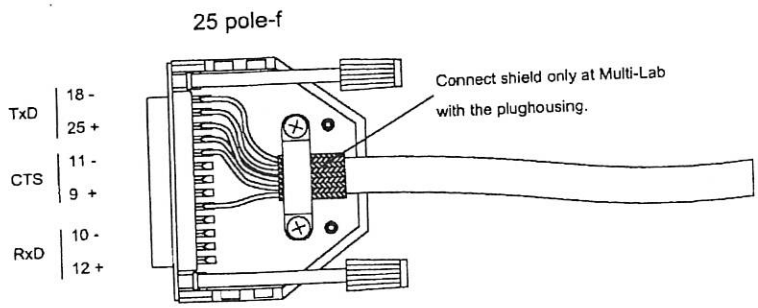
1.1 TTY 20 mA current loop, optical isolated for interference protection of long distance data transmission

Baud rate	max. cable length
300	2000 m
2400	500 m
9600	100 m

Precondition:

a) Multi-Lab active = 20 mA source
b) Receiver is designed for this baud rate
c) Cable cross section at least 0,5 mm²,
d) Shielded data cable; the shield connected with plug housing of the Multi-Lab

Connection Layout:



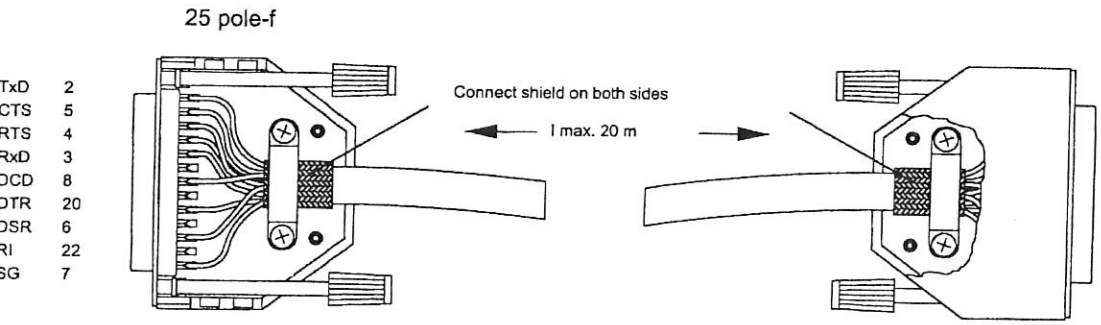
Do not connect all other plug pins!

The interface RS 232-V24 should be used for potential data transmission with periphery instruments, e.g. standard PC or Notebooks at close range. The cable length should not be longer than **20m**.

Attention !

is mode of operation both instruments (Multi-Lab and Periphery instrument) must be ected to the same mains voltage phase. Between the two instruments no potential difference e protective earth (PE = **P**rotective **E**arth) should exist; Otherwise, either the Multi-Lab or the hery instruments are destroyed!

nection Layout:

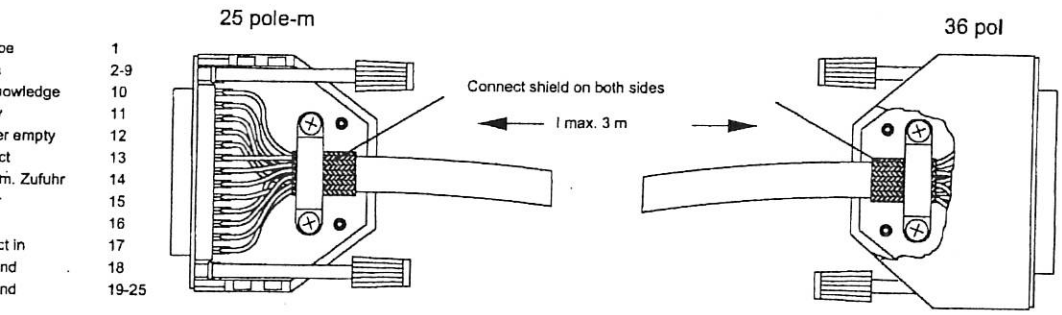


Do not connect all other pins !

allel Printer Interface (Centronics)

nterface is to connect standard printers with the so-called Centronics input. The cable length l not be longer than **3 m**. Standard cable length is 1,8 m.

ction Layout:



tion !

mode of operation both instruments (Multi-Lab and Periphery

9 Maintenance Notes

Resulting from its electronic design, Multi-Lab Celox requires no maintenance.

Since, immersion lances are subject to severe thermal and mechanical stress, it is recommended that the measurement set-up is checked once a week to ensure accurate measurement results. For a combined calibration and function test of the oxygen measuring unit and the lance, we recommend the use of our lance and calibration check system of the "Checkmate Celox". Apart from calibration control, the same system allows fast and reliable insulation checking of the immersion lance and compensation cable.

10 Hardware Calibration and Installation Instructions

10.1 Input Channels

Attention: measurement is not possible during the hardware test!

A calibration correction is not necessary since the unit regularly carries out an automatic self-adjustment process. However, if there are deviations, then proceed as follows:

1. connect calibrator to the input (Temp = 1600°C, EMF = 200mV)

2. select 8 = "Hardware test" item 5 = "Calibration" in the main menu

A software calibration can be made for Temp and EMF by using the build-in keyboard without opening the instrument. The correction values are stored in an EEPROM even after the instrument is switched off. After this do an internal calibration by pushing key <3> and repeat the software calibration if necessary.

3. exit calibration program with <ENT>

10.2 Option 0/4...20mA Board M-LAB-MA

An ampere meter with a resolution of at least 12 bits (according 2 decimals at the 20 mA range) is necessary to adjust the M-Lab-MA board.

The output resistance (P23/P33), the gain (P21/P31) and the Offset (P22/P32) have to be adjusted.

First the **output resistance** have to be adjusted. At the menu Hardware Test / mA-Test the card has to be switched to output 20 mA. A shunt of 475 Ohm has to be connected to the serial ampere-meter. The trimmer P23 (channel 1) and P33 (channel 2) has to be turned till the shorten of the shunt has no influence to the output current.

After this adjustment the **offset** has to be adjusted. The output current has to **set to 0 mA** at the menu mA-Test. Then the offset can be adjusted with trimmer P22 (channel 1) and P32 (channel 2).

Afterwards the **gain** has to be regulated. Therefore 20mA have to be selected via menu and controlled by the ampere meter. The current can be adjusted with the potentiometer P21 (channel 1) and P31 (channel 2). After the adjustment these three values have to be controlled once again.

error has been detected, the voltage of the D/A converter can be monitored at testing point
1 = GND channel 1 / TP31 = GND channel 2 and TP22/TP32 = voltage output ADC.

voltage has to be in the range of 0 and -2.5V according to the input data value.
points = 0 V, 4095 points = -2,5V)

allation:

nstallation it is important to set the correct jumper setting of JP1. If only one card is installed no bers are necessary. The card is now addressed on 34CH - 34FH. The program supports **one** e mA board. The second board needs a jumper on position A.

JP1	A	B	address range	
	0	0	340H - 343H	
	1	0	344H - 347H	
	0	1	348H - 34BH	2. mA-board, jumper on A
	1	1	34CH - 34FH	1. mA-board, no jumper (default)

0 = jumper set, 1 = no jumper.

Option BCD Board M-LAB-BCD

alibration is necessary for this board.

llation:

nstallation it is important to set the correct jumper setting of JP1. If only one card is installed no ers are necessary. The card is now addressed with the addresses 270H-27FH. The program orts two BCD-boards. The second needs a jumper on position A.

JP1	A	B	C	address range	
	0	1	1	260H - 26FH	2. BCD-board, jumper on A
	1	1	1	270H - 27FH	1. BCD-board, no jumper (default)

0 = jumper set, 1 = no jumper.

echnical appendix M-LAB-BCD for output connection of the BCD board.

11 Safety Regulations

The unit must be connected in compliance with the VDE 0100 "Regulations for establishing high voltage equipment with mains voltages below 1000 V".

Warning !

Before opening the equipment, it is essential that the mains voltage is switched off to all channels or that the mains plug is disconnected.

It should be noted that possible users connected (signalling system, horn) have their own power supply which must also be disconnected. Work at live system components may only be carried out by skilled technical personnel with utmost care.

Trouble shooting / Repairing hints

pen the unit, remove the upper cover.

ost all important components of the measuring unit can be replaced easily. This allows easy pment repair by the user.

electronic boards and assemblies must be handled with necessary care. Avoid damage to and rmation of components mounted on them.

se of repeat orders of individual assemblies, the device type, serial number, program version if necessary, the program number on the Flash-EPROM stickers of the AT board must be ated.

user should pay due attention to the following information on systematic troubleshooting edures. When the damage can not be eliminated by replacing the boards concerned, the petent service centre should be contacted, or the unit should be returned to the manufacturer epair. In the latter case it may be useful to indicate possible failure causes or any other rvations which might help to identify the failure cause.

isplay is dark

ondition: Unit is switched on

e:
a) lack of external mains voltage
b) mains line disconnected
c) mains fuse defective
d) power pack defective
e) connection cable VGA-board EL-display defective
f) VGA-board defective
g) EL-display defective

READY" message

ondition: Celox or temperature sensor mounted on lance

e:
a) measuring sensor defective
b) contact block of measuring lance defective
c) measuring lance or compensation line damaged
d) fault on pre-amplifier board M-LAB-01

MEASUREMENT" message

ondition: Measuring readiness OK, sensor immersed in melt

e:
a) twisted connection of compensation cable when "END" message is active after lance immersion
b) wrong temperature start value setting
c) wrong element type setting
d) fault on pre-amplifier board M-LAB-01

END" message

ndition: Measurement was carried out

e:
a) fault on pre-amplifier board M-LAB-01
b) fault on AT board

External signalling does not work

Precondition: Signalling on the screen OK

Cause: a) external signalling (bulbs) defective
b) fuses on signalling board M-LAB-RL defective

Display brightness too low or too high

Adjusting of brightness is possible by a potentiometer on the VGA EL - interface board (see technical appendix).

Error measurements

Precondition: Measurement was carried out

Cause:

	display
a) thermocouple break	111111°C
b) temp. < than temp. start	222222°C
c) no temperature plateau	333333°C
d) temp. > than temp. end	444444°C
e) EMF break (line break)	111111mV
f) EMF < than EMF start	222222mV
g) no EMF plateau	333333mV
h) EMF > than EMF end	444444mV
i) EMF cell break (24mV constant)	555555mV

j) error measurement as a result of turbulent bath conditions, e.g. during flushing and blowing
k) error measurement as a result of unstable lance holding
l) error measurement due to the use of wrong sensors
m) error measurement due to loose contact in lance cable/socket/internal cable
n) error measurement due to wrong setting of tolerance/plateau length/maximum measuring time
o) error measurement due to wrong setting of element type/start value
p) fault on pre-amplifier board M-LAB-01
q) calculation error:
a wrong formula-parameter causes an division by zero or an over- or underflow result.

No keyboard commands

Precondition: Display on monitor

Cause: a) printer output is activated (BUSY)
b) unit is in the DOS program D:/> switch mains power off and on

Security code not accepted

Cause: a) security code wrong or unknown. Pull red jumper on AT Computer board and close it again. The unit works with its standard process parameters default (**Code: 2448**).

Warning: **All stored measurements and custom settings are cleared afterwards !**

Error message "RAM DISK ERROR"

Cause: a) problems during writing or reading the RAM-disk memory.
switch mains power off and on
delete RAM-Disk files (point 9 of main menu)
load standard parameters (point 2 of main menu)
change battery on AT - board (type 3.6V Lithium SL-340 INORGANIC)

Packing Recommendations

ce the Multi-Lab is a high-quality electronic measuring unit, it should only be dispatched in its inal packing. If the original packaging is no longer present, then it is advisable to properly pack Multi-Lab in a sufficiently large carton lined with a shock-absorbing material such as wood vings, polystyrene flakes or similar. The shock-absorbing layer should have a minimal thickness 0 cm at each side. Before packing the Multi-Lab, it must be wrapped in paper or plastic film.

overseas, the unit must be welded into air-tight plastic film, with a siccative added. The sport container used for this kind of shipment must be lined with oiled paper.

se packing recommendations also apply when returning the unit to the manufacturer.

Technical Data

ication:

perature/EMF-measurement, calculation of a(O), %Al, %C, kgAl, SLAC

perature Measuring Ranges:

t-term measurement, switchable to continuous measurement
S (Pt 10% Rh/Pt) 400°C...1760°C
R (Pt 13% Rh/Pt) 400°C...1760°C
B (Pt 30% Rh/Pt 6%) 600°C...1820°C
metically linearised IEC 584 / IPTS 68 / IPTS48
erature display °C/°F, resolution 0.1°C

-Measuring Range:

mV ... + 400 mV resolution 0.1 mV

rence Temperature:

with cold junction compensation, actual temperature measurement at the input socket

racy:

erature: ±1°C EMF: 1 mV (by 18 to 28°C ambient temp.)
erature: ±2°C EMF: 1 mV (by 0 to 50°C ambient temp.)

od of Evaluation:

au determination by means of mean value calculation and detailed faulty measurement nition

nation Unit:

-flat display with polarisation filter screen

Operation:

Menu-led operation via 16-key membrane keypad.

Measured Data Storage:

approx. 400 measurements. The max possible number of measurements to be stored is displayed in the initial menu.

Program Data Storage:

Battery-buffered. Storage period approximately 5 years (Lithium battery 3.6V)

Date/Time:

Battery-buffered real time clock

Measurement Location Input:

max. 2 digit, input via keypad (1...99) alternatively BCD-input (1...19 via potential-free contacts)

Heat-No. Input:

max. 8 digit input via keypad (optionally via external input)

Test Functions:

Unit self-adjustment, measuring circuit monitoring and function monitoring

Operational Data:

Supply requirement 100...240 V AC +10/-15%, 50...60 Hz, fuse 2 A MT
Idle power consumption max 60 VA
Ambient temperature 0°C...+50°C

Signal Outputs:
"READY", "MEASUREMENT", "END", "ERROR-MEASUREMENT", "CELOX",
output via potential-free reed relay contacts,
max. switching voltage 100 V eff., max. switching current 300 mA, max. breaking capacity 10 VA

additional:
"READY", "MEASUREMENT", "END", "ERROR-MEASUREMENT", "HORN",
output via solid state relays, switching voltage 60...240 V, 47...63 Hz, max. switching current 2 A

or (optional):
output via potential-free reed relay contacts,
max. switching voltage 100 V eff., max. switching current 300 mA, max. breaking capacity 10 VA

"Transmission-complete"-pulse, output via potential free reed relay contact. Programmable command period

Data Outputs:
-Centronics interface for a parallel printer located near by the Multi-Lab
-Serial interface TTY 20 mA/V 24, selectable parameters
-Computer interface TTY 20 mA/V 24, selectable parameters

Output: (optional, 2 outputs on one board)

A corresponding to measuring range, galvanic isolated, dynamic or stored, programmable
g range, max. Resistance 500 Ohm, resolution 0.0048 mA, for temperature and EMF,
a(O) and %AL / %C

ut: (optional, 2 outputs on one board)

ure, a(O), EMF, %Al/%C, 5 digits parallel with decimal-point, positive / negative logic,
"data-valid"-command after completed measurement, programmable command-period,
potential free reed relay contacts, max. switching voltage 100 V effective, max. switching
0 mA, max. breaking capacity 10 VA

(optional)

, bath-level delayed, lance fast, lance slow, lance reverse. Output via potential free reed
acts, max. switching voltage 100 V effective, max. switching current 300 mA,
king capacity 10 VA

ome position, lance move down, clear bath level, start, emergency. 24V Logic, potential
tocoupler with power supply 2 * 24V/2W.

Potential: A maximum of three optional boards can be fitted.

imensions/Weight:

l housing, height 4 HU, with carrying handle for 19" rack mounting,
nel installation and table positioning, protection IP 43

s:
mm, width 489 mm, depth 335 mm

nel cut-out:
mm + 1 mm, width 444 mm + 1 mm

kg

ing: (optional)

ith transparent door for wall mounting, protection IP 65

s:
mm, width 600 mm, depth 560 mm

Declaration of Conformity

erence: This instrument comply with the EC Low Voltage Directive 73/23/EEC and the international harmonised safety standards for electrical equipment for measurement IEC 1010-1 and the national standard DIN VDE 0701, repair, modification and test of electrical instruments.

This instrument came up suitable to EC instruction 89/336/EEC to

16 Spare Part List

Art. No.	Order No.	Description
		Electronic components
20684	RM 24 255 500	AT-computer board assembled with 4 MB RAM and Flash E-Prom with program Celox
444025	RM 24 255 506	VGA-board
444373	RM 24 255 315	Serial-board M-Lab-CL V4
444019	RM 24 255 505	Passive-AT-bus board
444023	RM 28 255 041	Switching power supply 60 VA
47871	RM 28 255 043	9"-EL-Display
444679	RM 24 255 317	Pre-amp board M-Lab-01 V5/CX
4447010	RM 24 255 326	Solid state relay board M-Lab RL-S1/CX
4447000	RM 24 255 327	Reed-relay board M-Lab RL-R1/CX
20624	RM 24 255 328	BCD- board M-Lab-BCD/CX
444705	RM 24 255 303	Bath level board ML-DIS-1
444659	RM 24 255 329	Analogue output board 2- channel M-Lab-MA V2
444767	RM 28 255 048	Driver board for EL-Display ML-VIB 3
		Mechanic components
20798	RM 24 255 382	Housing 4 HU consisting of: bottom, cover, 2 pcs. connecting rails, left fixing angle and right fixing angle
46017	RM 24 255 383	Front stand (2 pcs. necessary)
46018	RM 24 255 384	Rear stand (2 pcs. necessary)
46094	RM 24 255 385	Handle for housing (2 pcs. necessary)
20793	RM 24 255 391	Front panel Celox with 16-key membrane keypad and polarisation filter screen
46622	RM 24 255 387	Polarisation filter screen
		Expendable components
47524	RM 24 255 344	Fine wire fuse 250 V, 2 A MT medium slow (1 unit = 10 pcs.) for main power
47506	RM 24 255 344	Fine wire fuse 250 V, 2 A FF very fast (1 unit = 10 pcs.) for signalling solid state relay
47515	RM 38 255 417	Fine wire fuse 250 V, 315mA T slow (1 unit = 10 pcs.) for signalling reed relay

o.	Order No.	Description
		Internal connectors
	RM 24 255 325	Power plug with mains filter, mains fuse and ON/OFF switch
	RM 24 255 390	Celox- 4-pol. flange socket "Measuring input" for ML-Celox with temperature compensation and EMC- protection, with approx. 600 mm shielded connecting cable 7 x 0,25 mm^2
	RM 38 255 116	Flange plug 5-pol. "Signalling solid state relay"
	RM 24 255 366	Flange plug 6-pol. "Signalling reed relay"
	RM 38 255 114	Flange plug 3-pol. "Horn"
	RM 24 255 349	Flange socket 8-pol. "Measuring station input"
	RM 38 255 170	Flange socket 4-pol. "mA output"
	RM 24 255 388	Flange socket 25-pol. Sub-D with board ML-ECT-1-EMV
	RM 24 255 389	Flange plug 25-pol. Sub-D with board ML-ESR-1-EMV
	RM 24 255 394	Flange socket 36-pol. "BCD I" incl. connecting cable
	RM 24 255 395	Flange socket 36-pol. "BCD II" incl. connecting cable
	RM 24 255 296	Flange socket 36-pol. "BCD III" incl. connecting cable
	RM 24 255 397	Flange socket 36-pol. "BCD IV" incl. connecting cable
	RM 24 255 377	Flange plug 7-pol."Bath level contact output"
	RM 24 255 379	Flange socket 7-pol."Bath level contact input"
		External connectors
	RM 24 167 005	Mains power cable, 1.5 m
	LC 33 016 071	Celox- coupler plug 4-pol. " Measuring input"
	RM 38 255 117	Coupler socket 5-pol. "Signalling solid state relay"
	RM 24 255 330	Coupler socket 6-pol. "Signalling reed relay"
	RM 38 255 115	Coupler socket 3-pol. "Horn"
	RM 24 255 331	Coupler plug 8-pol. "Measuring station input"
	RM 38 255 171	Coupler plug 4-pol. "mA output"
	RM 38 255 107	Coupler plug 25-pol. Sub-D with housing "Printer"
	140 149 11	Coupler socket 25-pol. Sub-D with housing "Serial"
	RM 34 255 010	Coupler plug 36-pol. "BCD" with housing
	RM 24 255 378	Coupler socket 7-pol. "Bath level contact output"
	RM 24 255 380	Coupler plug 7-pol. "Bath level contact input"

Heraeus

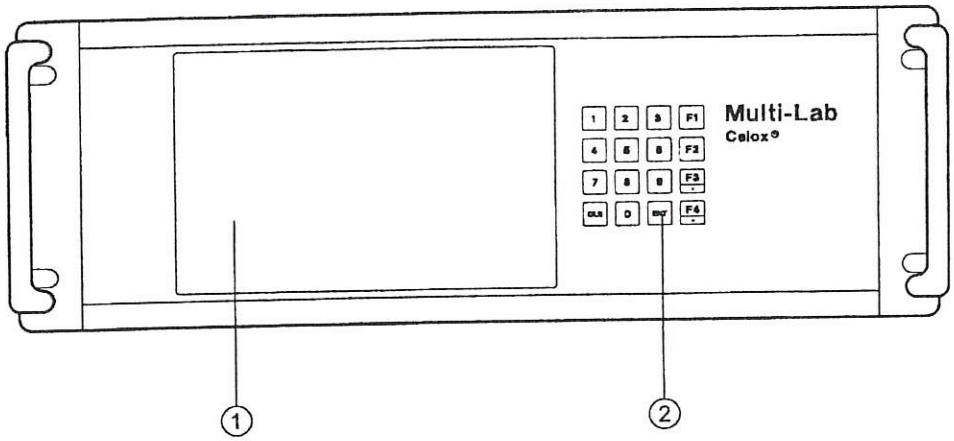
Technical appendix

Multi-Lab Celox

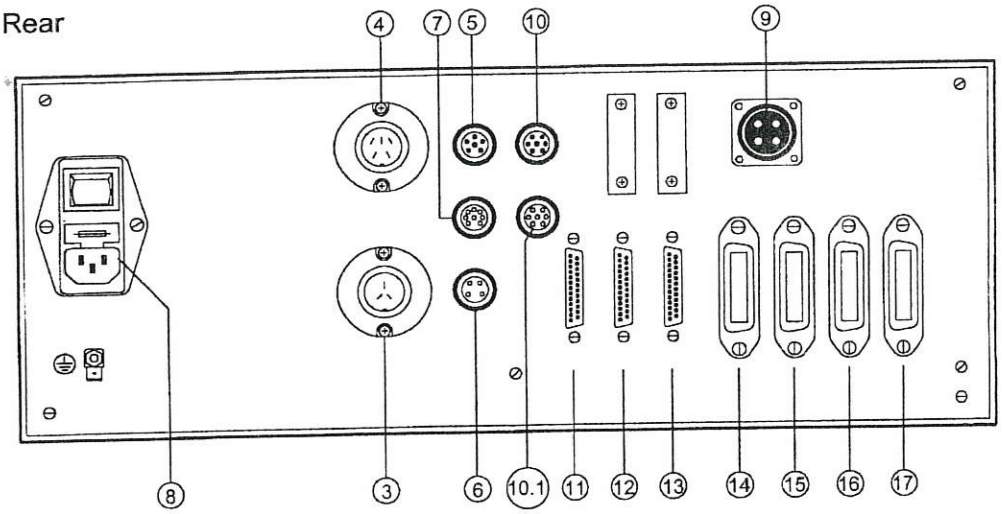
Table of contents

Front- and Rear view

Front



Rear



9" EL-Display
16 key membrane keypad
contact „horn": solid-state
or reed-relay
Signalling output solid-state
or reed relay
Signalling output reed relay
Analogue output 0/4 ... 20 mA I + II (Option)
Measurement station input „transmission end" output
Mains input with 2 fine wire fuses 2 AT
and on/off switch.

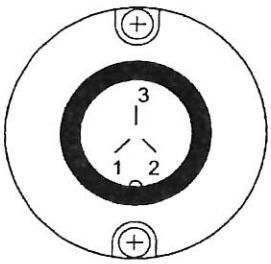
9 = 4-pole measurement input Temp./EMF
10 = Contact output „bathlevel" (Option)
10,1 = Contact input „bathlevel" (Option)
11 = Printer output (Centronics)
12 = Serial RS 232-output I
13 = Serial RS 232-output II
14- 17 = BCD output I – IV (Option)

2 Pin assignment

2.1 Signalisation output Solid-State

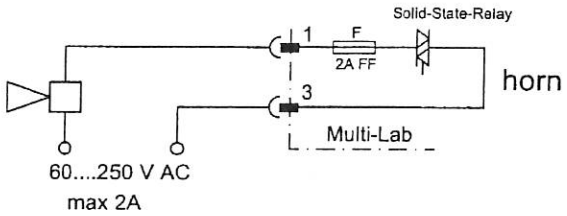
external view

③



Male socket 3 pole type 09-0035-00-03

Female cable connector 3 pole type 09-0034-00-03



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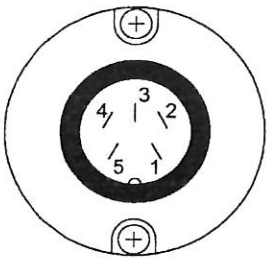
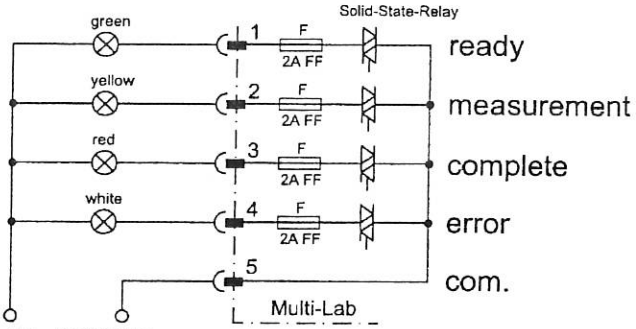


Male socket 5 pole type 09-0039-00-05

Female cable connector 5 pole type 09-0038-00-05



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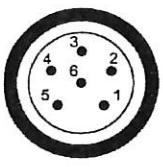
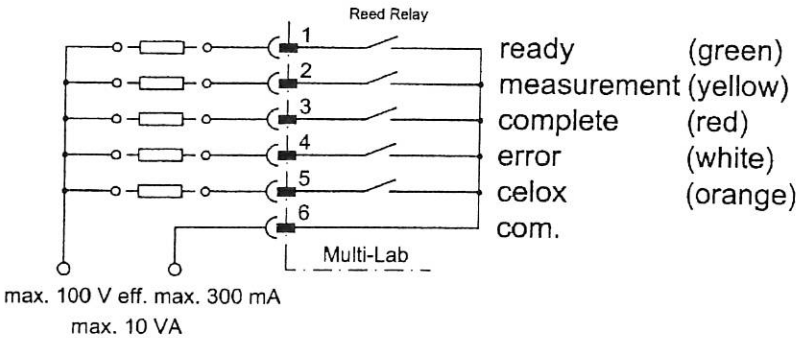


Male socket 6 pole type 09-0323-00-06

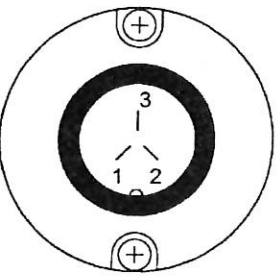
Female cable connector 6 pole type 09-0022-00-06



ignalisation output Reed Relay

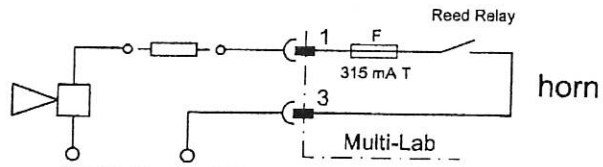
external view

③



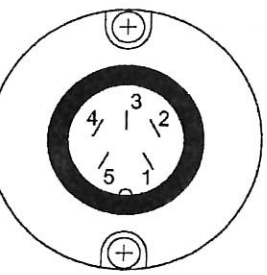
Male socket 3 pole type 09-0035-00-03

Female cable connector 3 pole type 09-0034-00-03



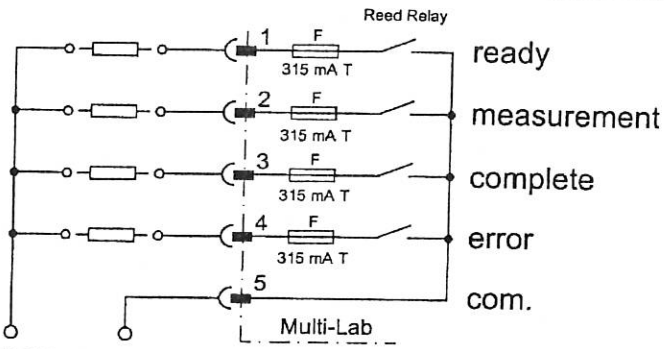
max. 100 V eff. max. 300 mA
max 10 VA

④



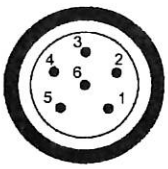
Male socket 5 pole type 09-0039-00-05

Female cable connector 5 pole type 09-0038-00-05



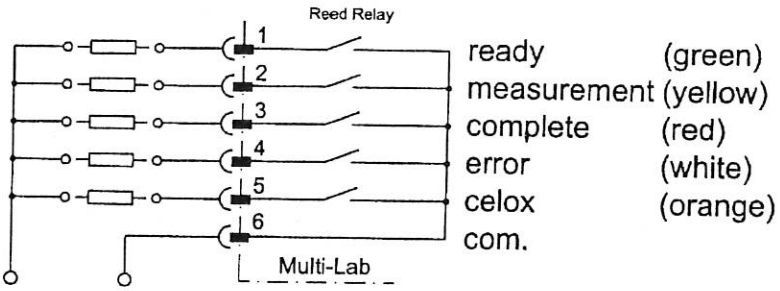
max. 100 V eff. max. 300 mA
max 10 VA

⑤



Male socket 6 pole type 09-0323-00-06

Female cable connector 6 pole type 09-0022-00-06

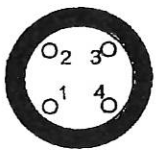


max. 100 V eff. max. 300 mA
max. 10 VA

2.3 0/4 ... 20 mA Analogue output

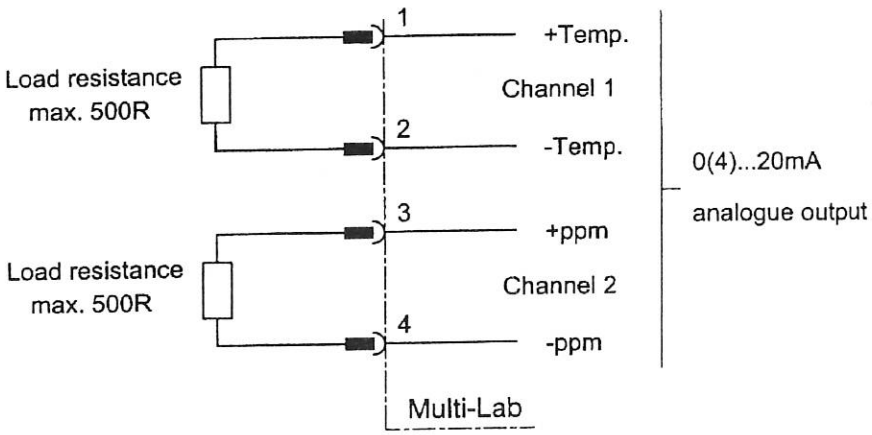
external view

⑥



Female socket 4 pole type 09-0312-00-04

Male cable connector 4 pole type 09-0009-00-04

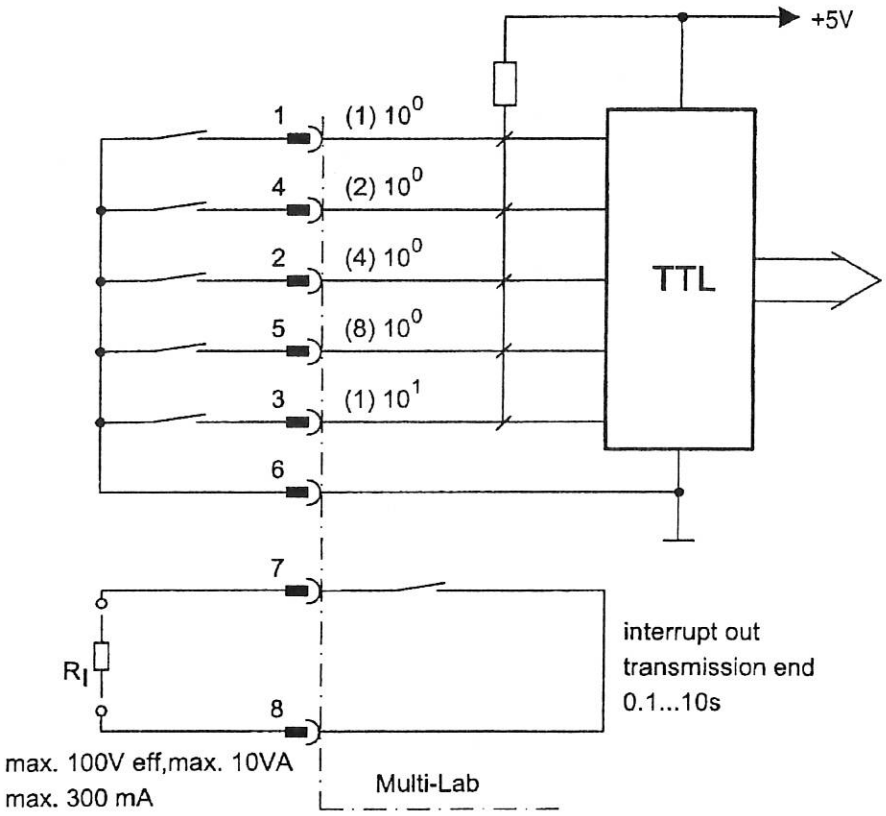


ternal measurement station input

Female socket 8 pole type 09-0070-00-08
Male cable plug 8 pole type 09-0067-00-08

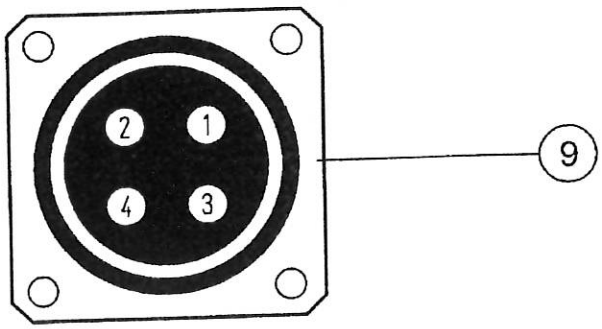
nal view

BCD-Measurement station 00...19



2.5 Measurement input for temperature and EMF

Male cable plug Nr.: 45010



measurement input

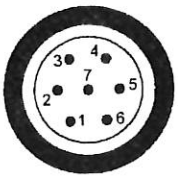
1 = + Temp.	compensating cable type 28 al Celox
2 = - Temp	
3 = + EMF	
4 = - EMF	

Bathlevel (option)

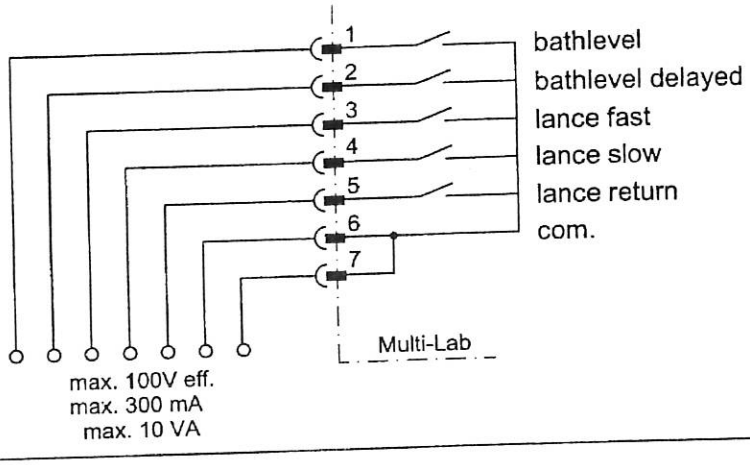
external view

Male socket 7 pole type 09-0757-00-07
Female cable connector 7 pole type 09-0026-00-07

(10)

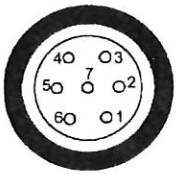


Control out (application contacts)

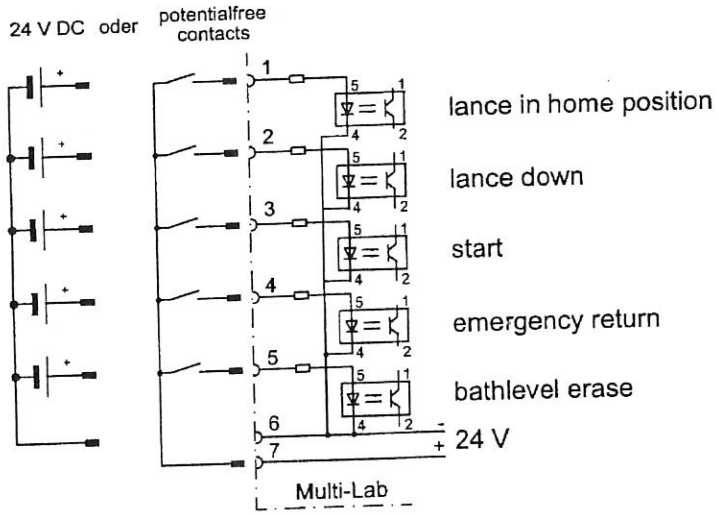


Female socket 7 pole type 09-0828-00-07
Male cable plug 7 pole type 09-0025-00-07

(10.1)



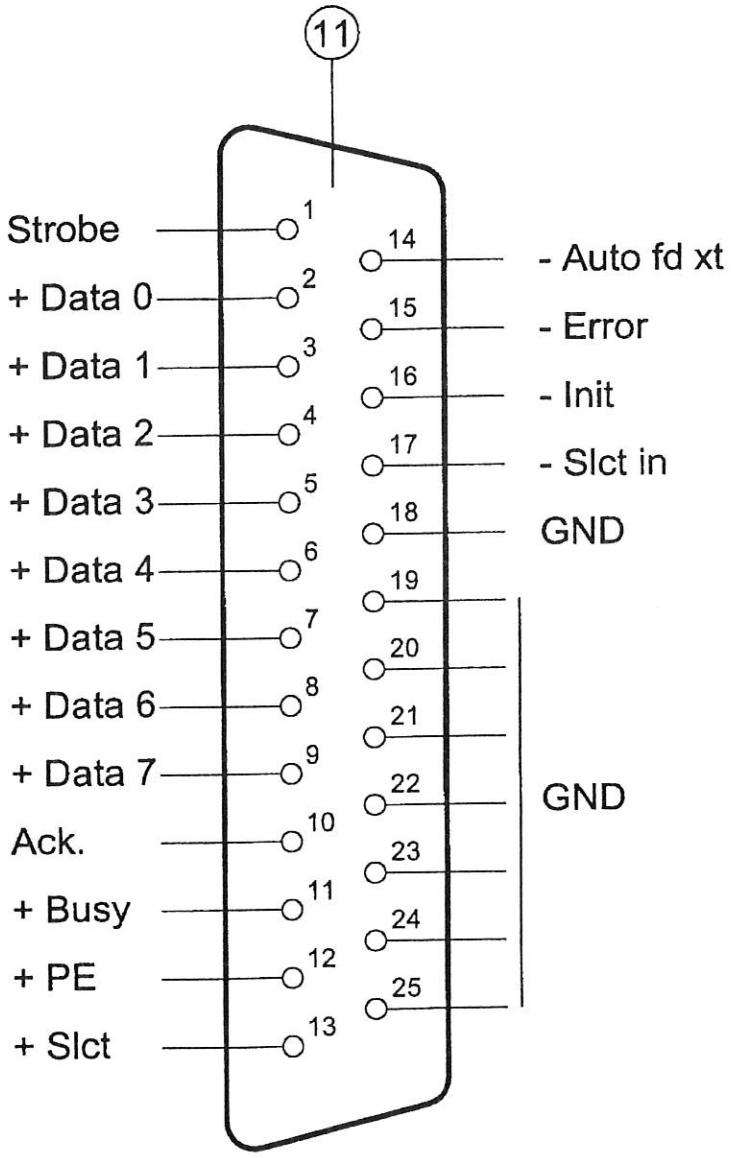
Control in (lance contacts)



2.7 Printer output

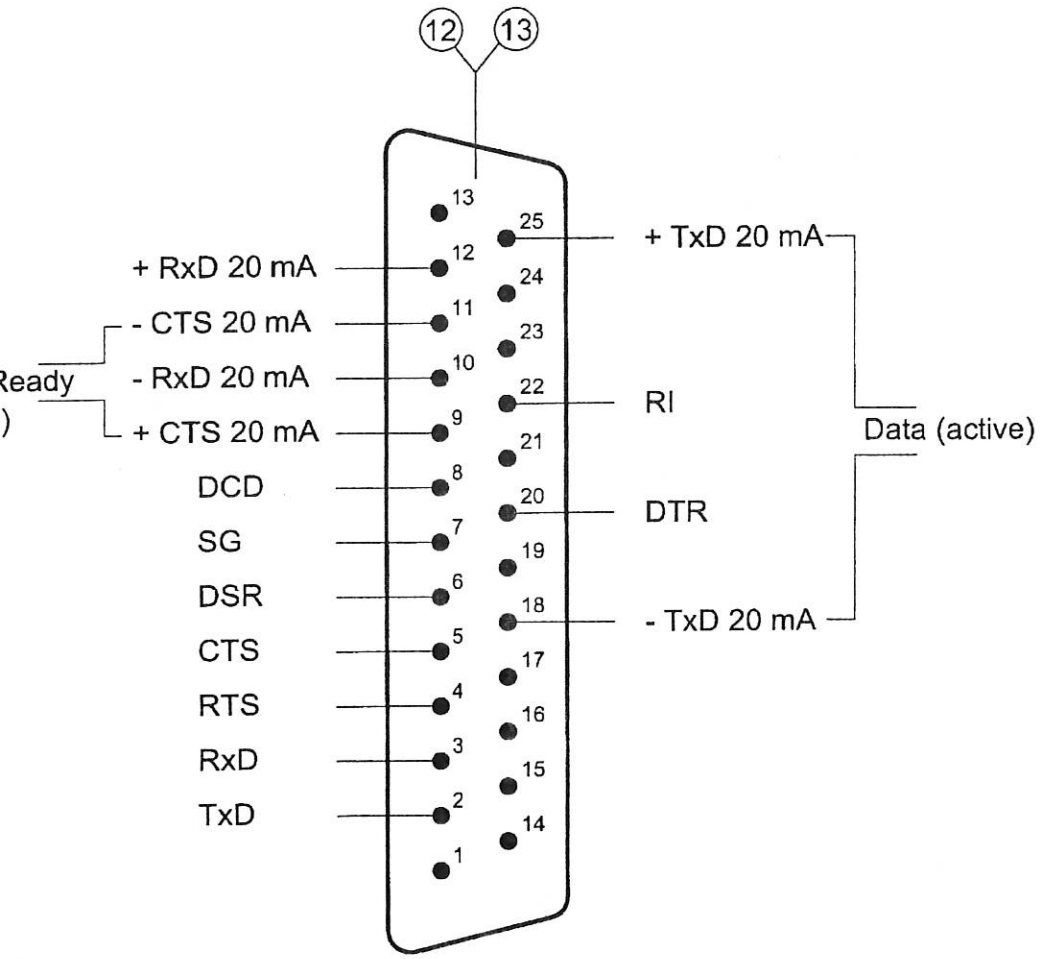
plug 25 pole type DB-SF-255

Male cable connector 25 pole type 09-67-225-2604



al output

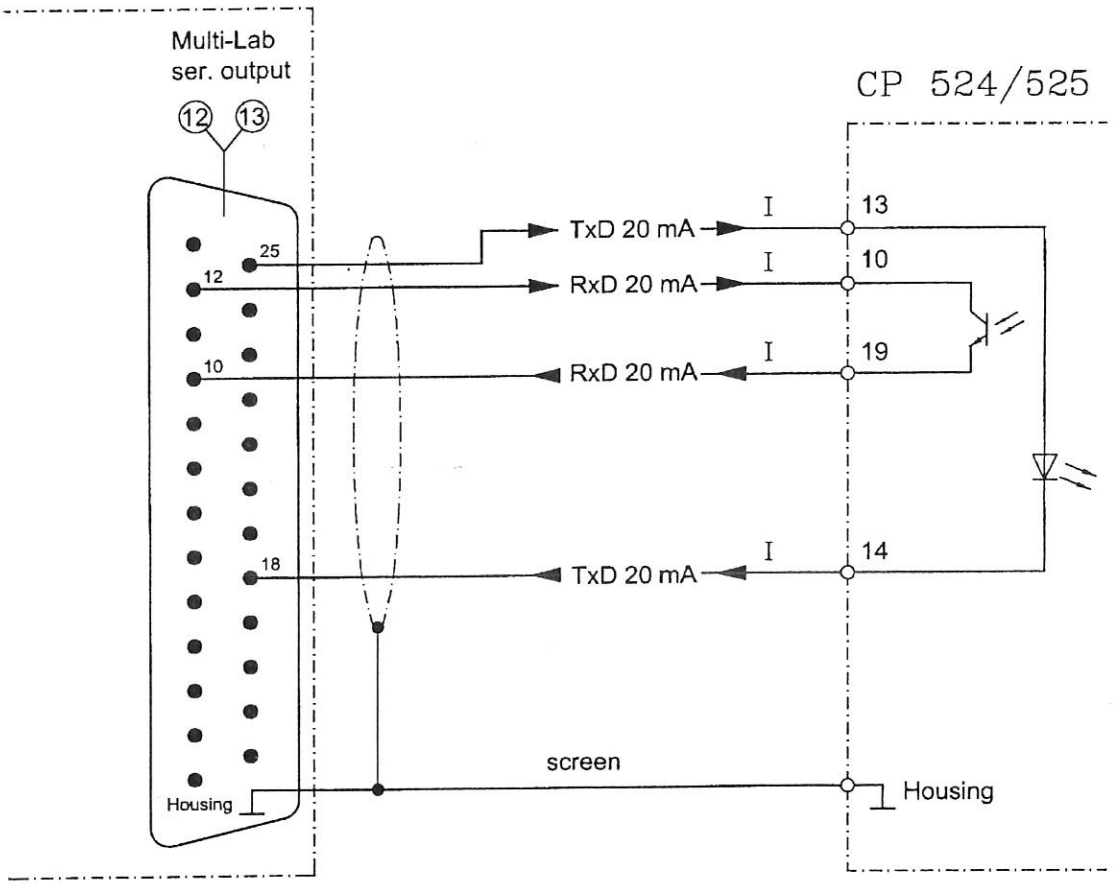
Male plug 25 pole type DB-SF-25P
Female cable connector 25 pole type 09-67-225-2704



standard setting: all 20 mA current loop active

2.9 Connection Multi-Lab – CP 525

Connection diagram and current line for the connection Multi-Lab – Siemens Simatic CP 525.
Current loop Multi-Lab active.



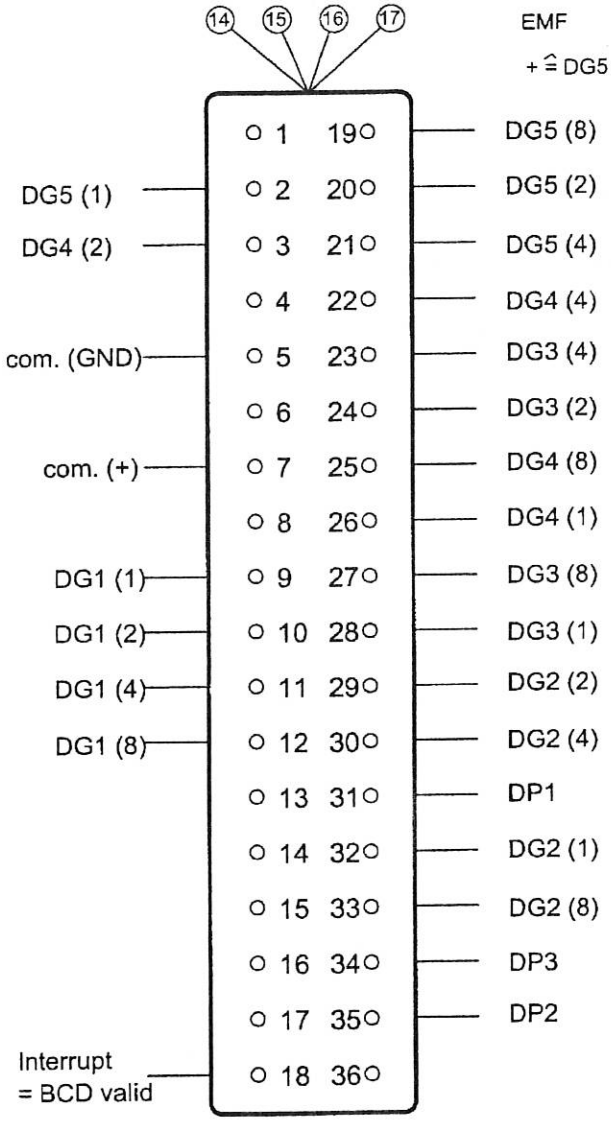
2.10 BCD output

5-digit display

DG5	DG4	DG3	DG2	DG1
	DP3	DP2	DP1	

Temp	0000.1 ..... 9999.9
a(O)	00.001 ..... 99.999 100.00 ..... 999.99 1000.0 ..... 9999.9
C% / Al%	00.001 ..... 99.999
EMF	-999.1 .... +999.9 D

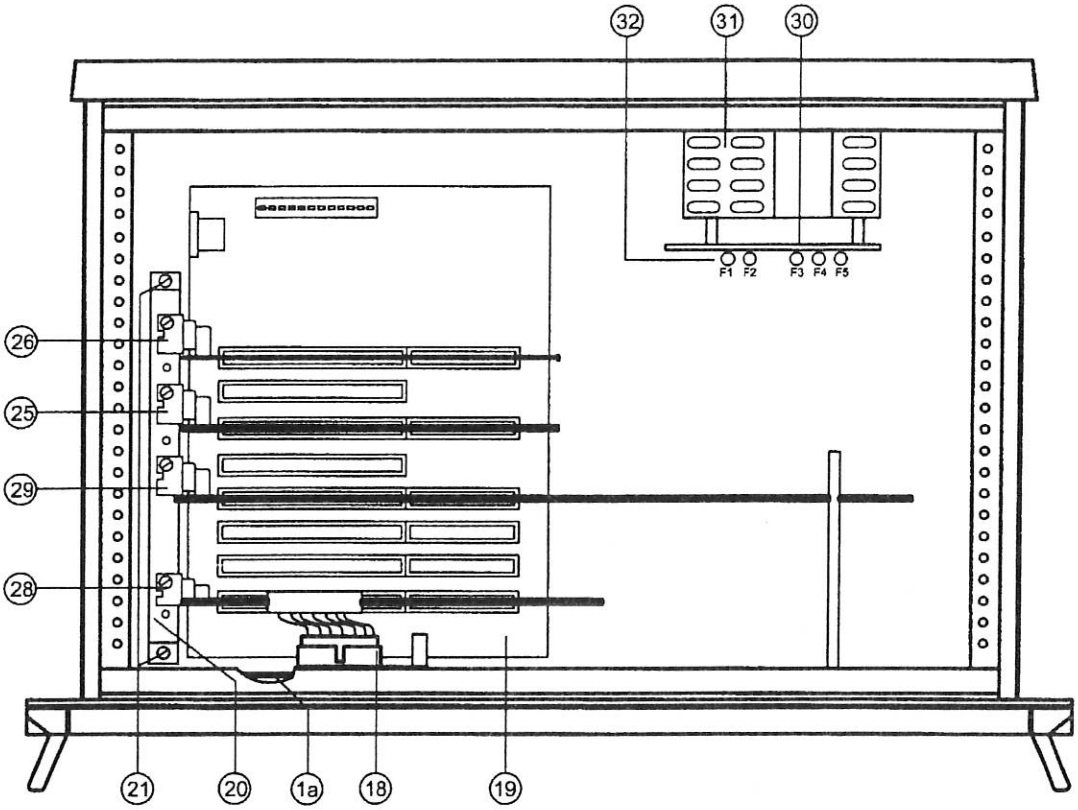
+ ≙ DG5 = 0 - ≙ DG5 = 8



plug 36 pole type 609-36F

male cable connector 36 pole type Amp. 05730360

3 Internal view



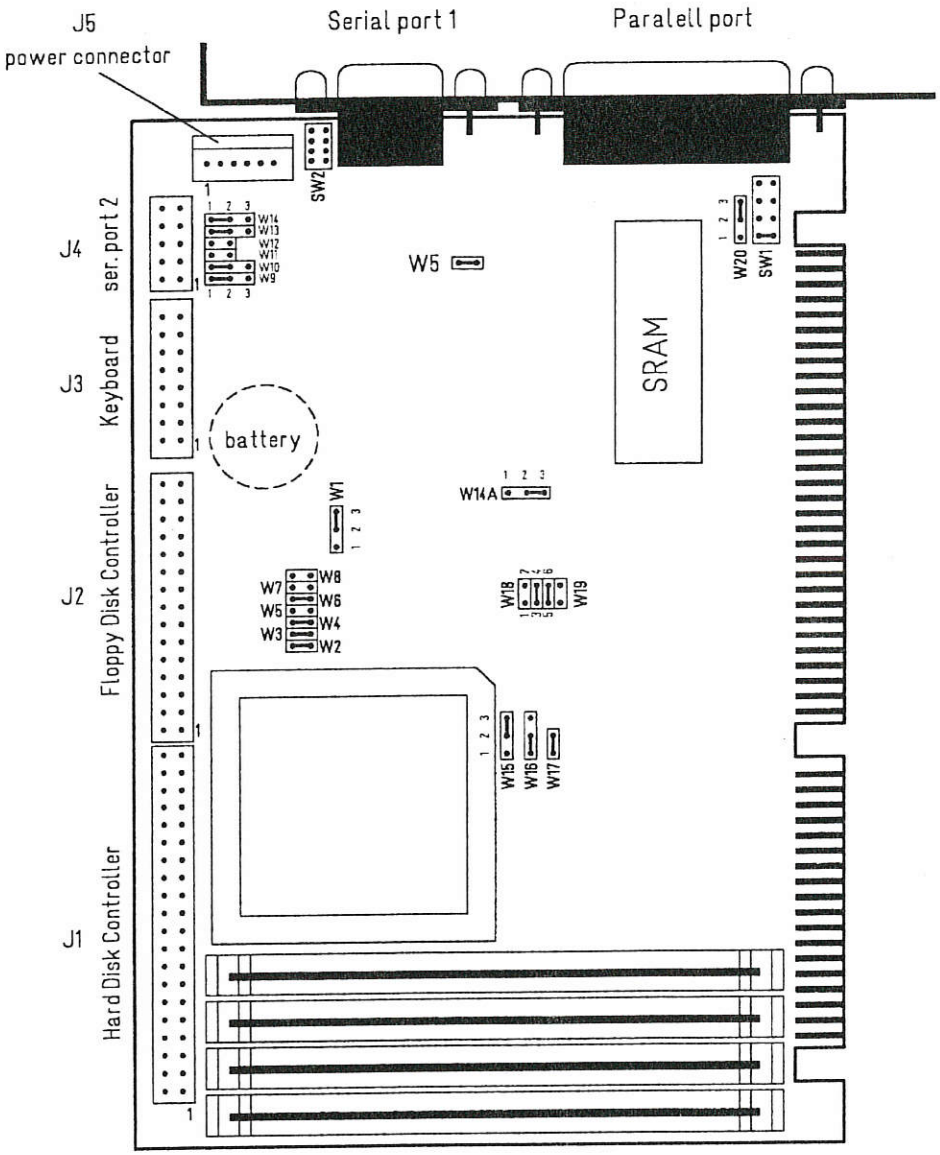
1a	Control board EL Display
8	mains input with 2 fine wire fuses 2 AT MT and on/off switch
18	VGA EL interface board
19	Passive AT BUS board
20	Electronic board retaining clamp
21	fixing screws for retaining clamp
25	M-LAB-CL serial output board
26	AT Computer Board
28	VGA video board
29	M-LAB-01-CX pre-amplifier board celox
30	M-LAB-RL-CX signalling output board celox
31	power supply 85 ... 264 V AC, 60 VA
32	Signalling fuses

optional boards: **Maximum insertion 3 optional boards.**

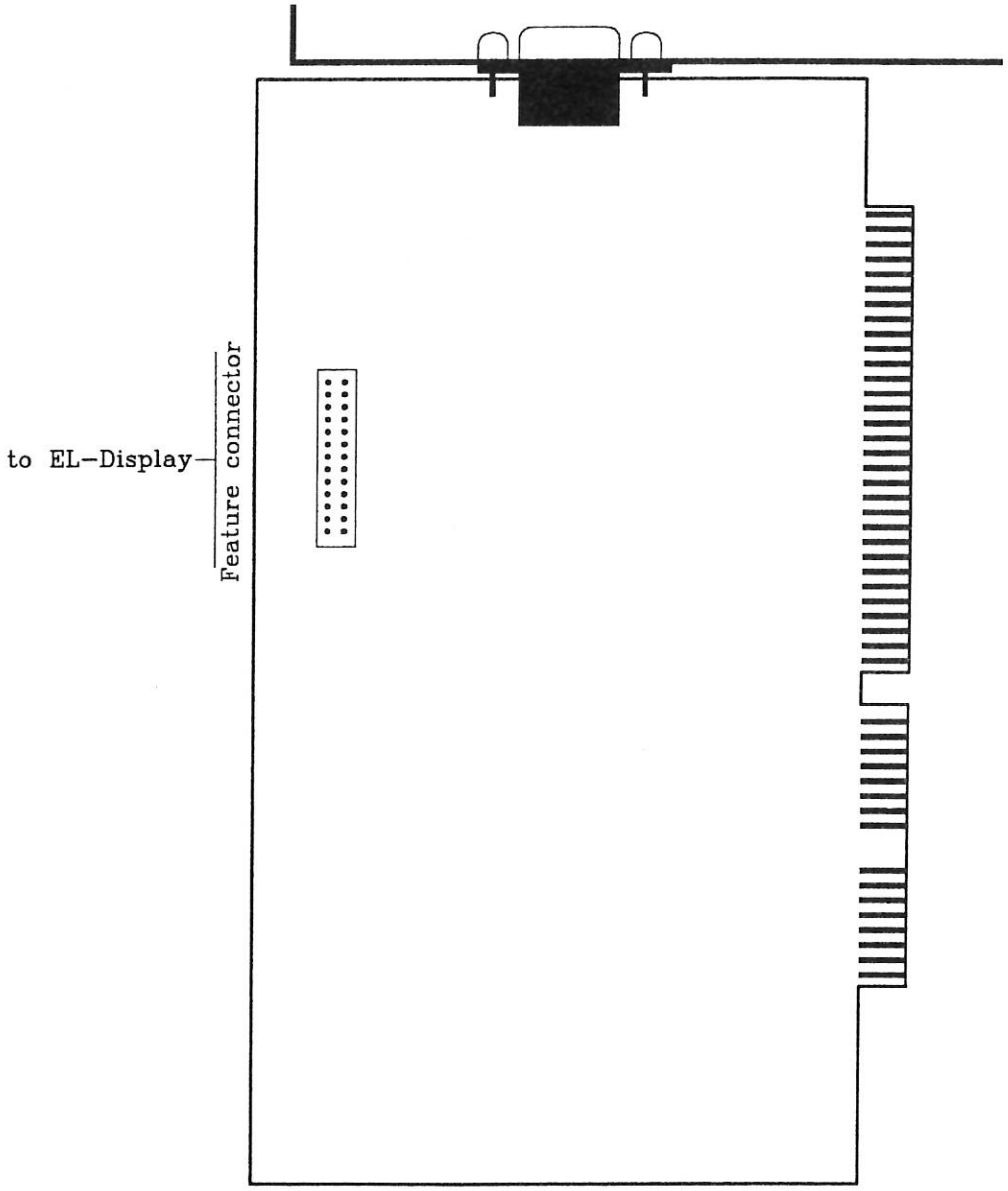
M-LAB-BCD I + II	BCD output
M-LAB-BCD III + VI	BCD output
M-LAB-MA I + II	mA output
ML-DIS-1	bathlevel detection

Standard settings of electronic boards

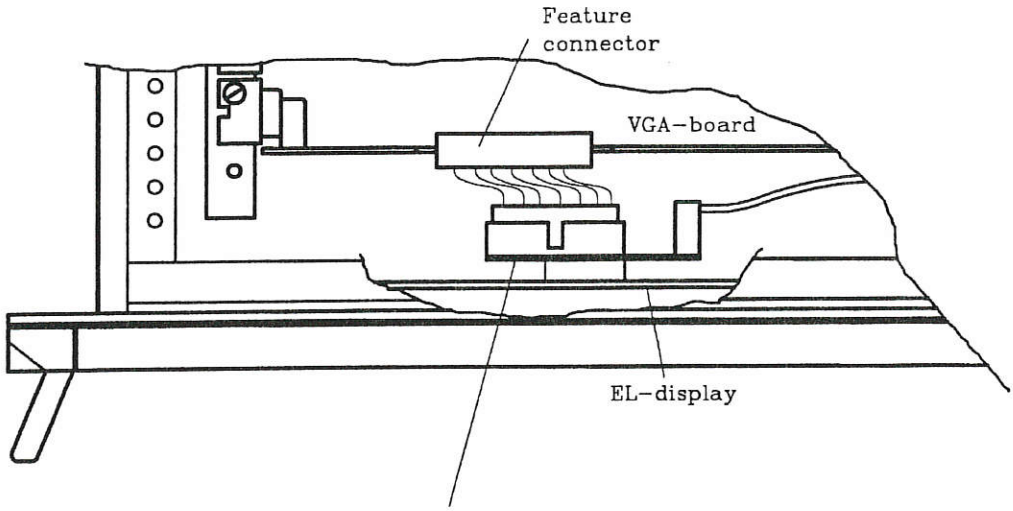
Jumper setting AT Board



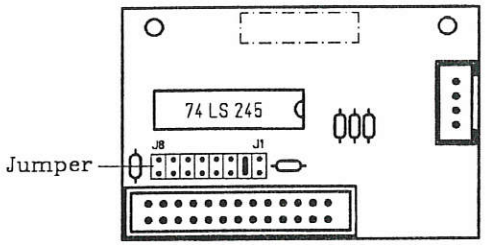
4.2 VGA board



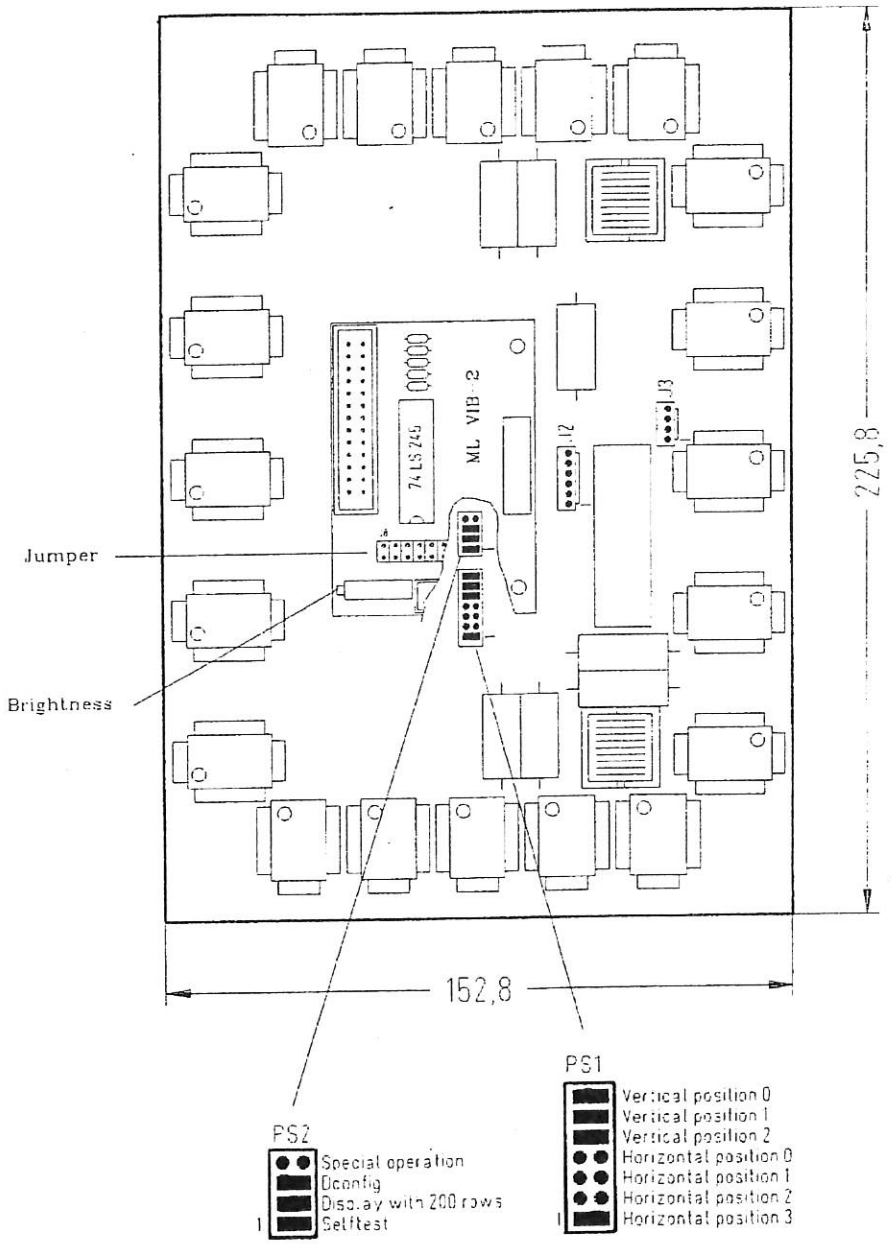
.3 VGA Interface



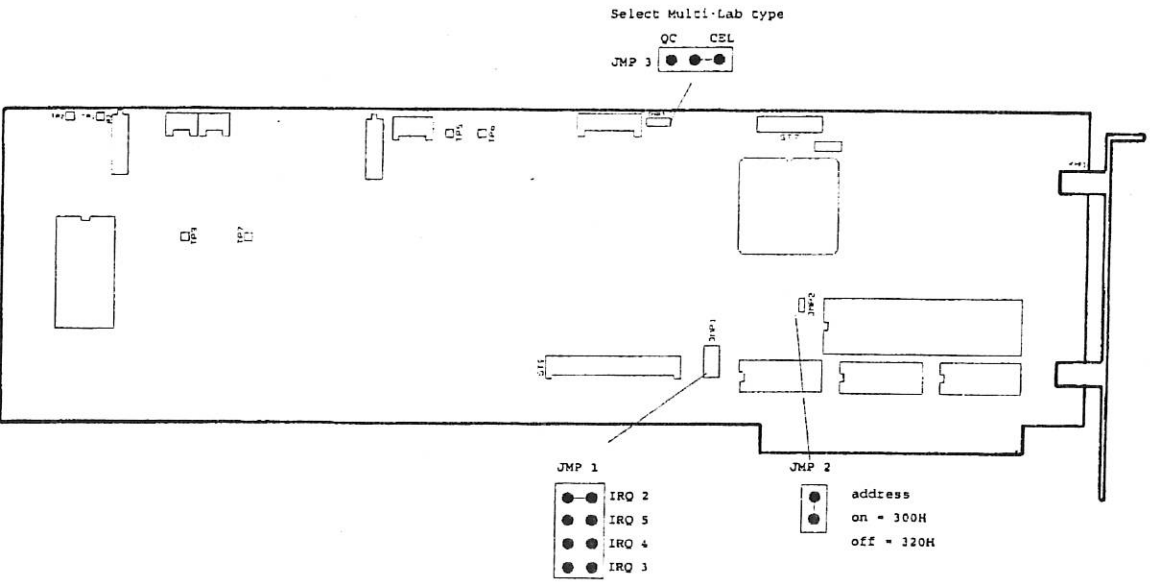
VGA Interfaceboard



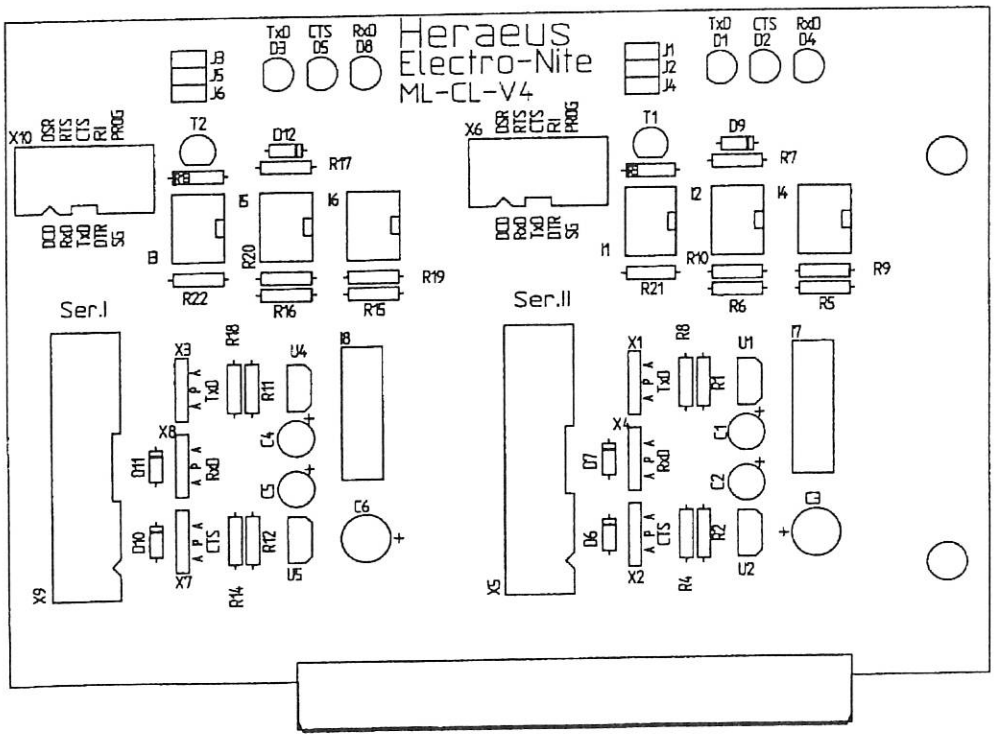
4.4 Jumper setting EL-Display



Jumper setting M-Lab-01



4.6 Jumper setting M-LAB-CL

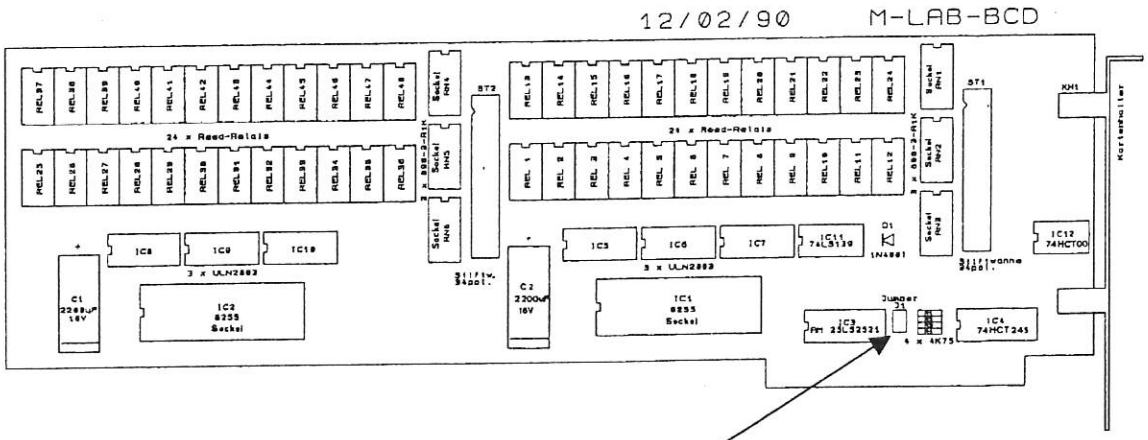


Aufdruck Bestückungsseite (1.00 09/02/99 ml-cl-v4.fc)

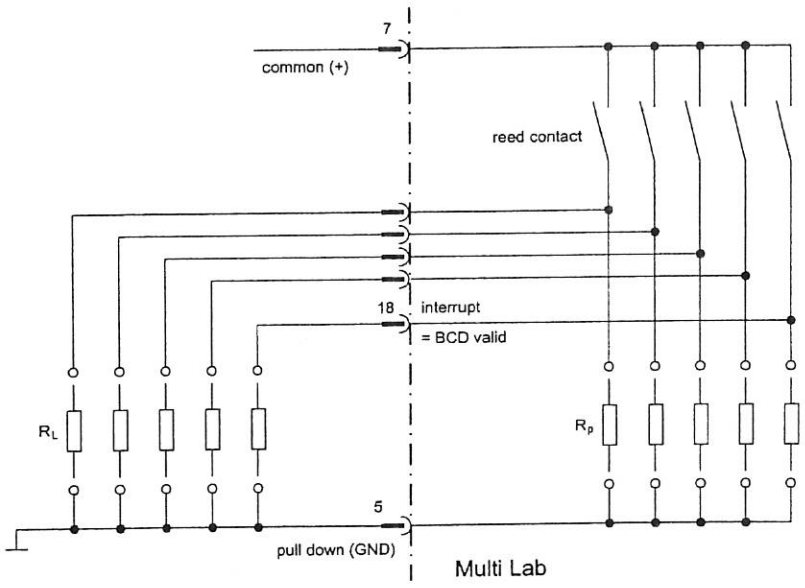
Ser. I		Ser. II	
J3	TxD enable	J1	TxD enable
J5	CTS enable	J2	CTS enable
J6	RxD enable	J4	RxD enable

Ser. I				Ser. II			
active		passive		active		passive	
X3		X3		X1		X1	
TxD		TxD		TxD		TxD	
X8		X8		X4		X4	
RxD		RxD		RxD		RxD	
X7		X7		X2		X2	
CTS		CTS		CTS		CTS	

4.8 Jumper setting M-Lab-BCD



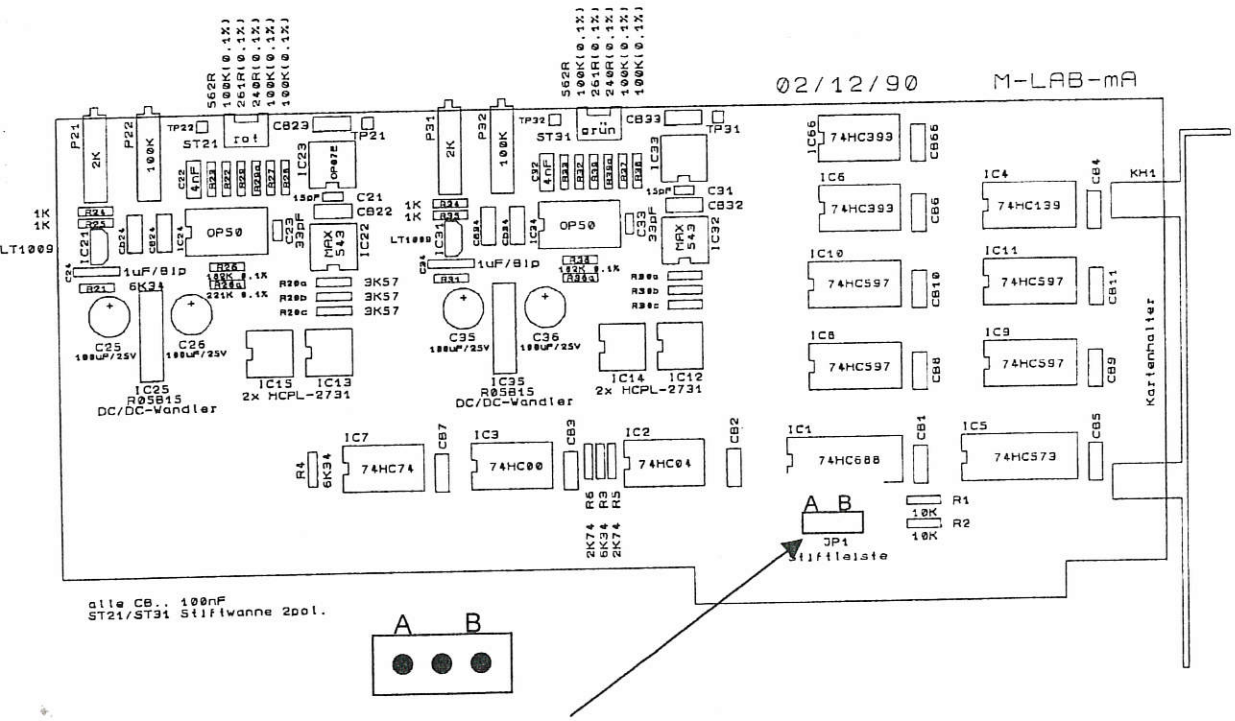
A	B	C	address	
set	free	free	260H – 26FH	2. BCD Board
free	free	free	270H – 27FH	1. BCD Board (default setting)



common (+) 5. . . 12V : R_P=1K, R_L > 10K
common (+) > 12V : R_P remove *
maximum contact load capacity of reed relay: 100V eff., 300mA, 10 VA
Positive Logic: BCD-"0" = all contacts open
Switch over to negative logic can be done through menu on screen.
Other external wiring possible.

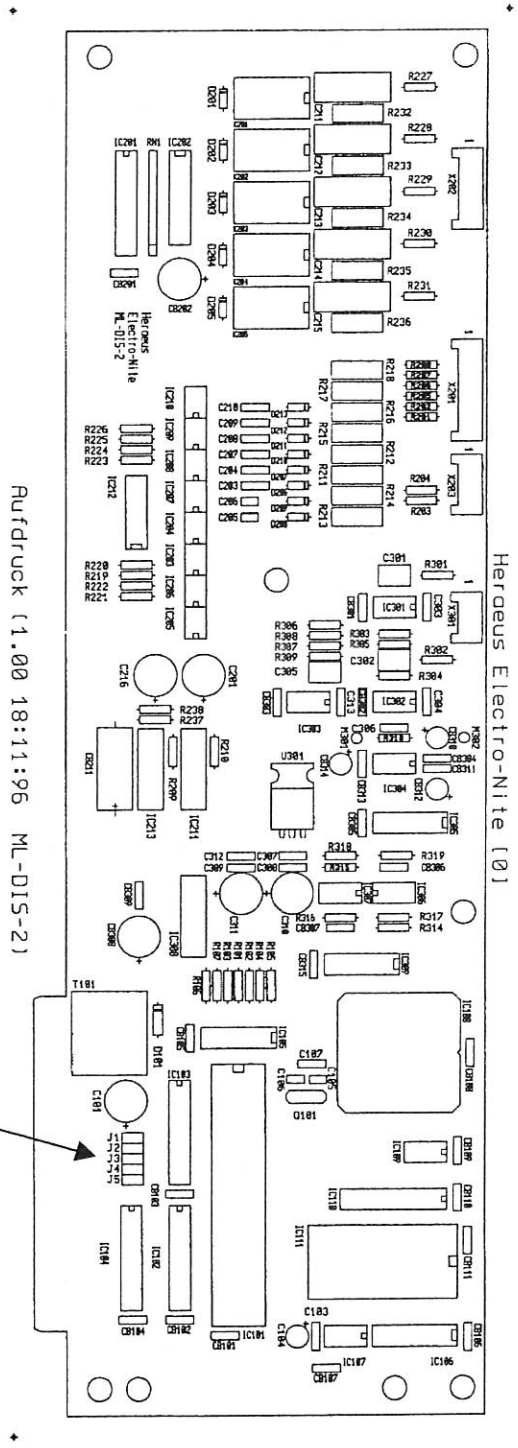
*** = factory setting**

.9 Jumper setting M-LAB-MA



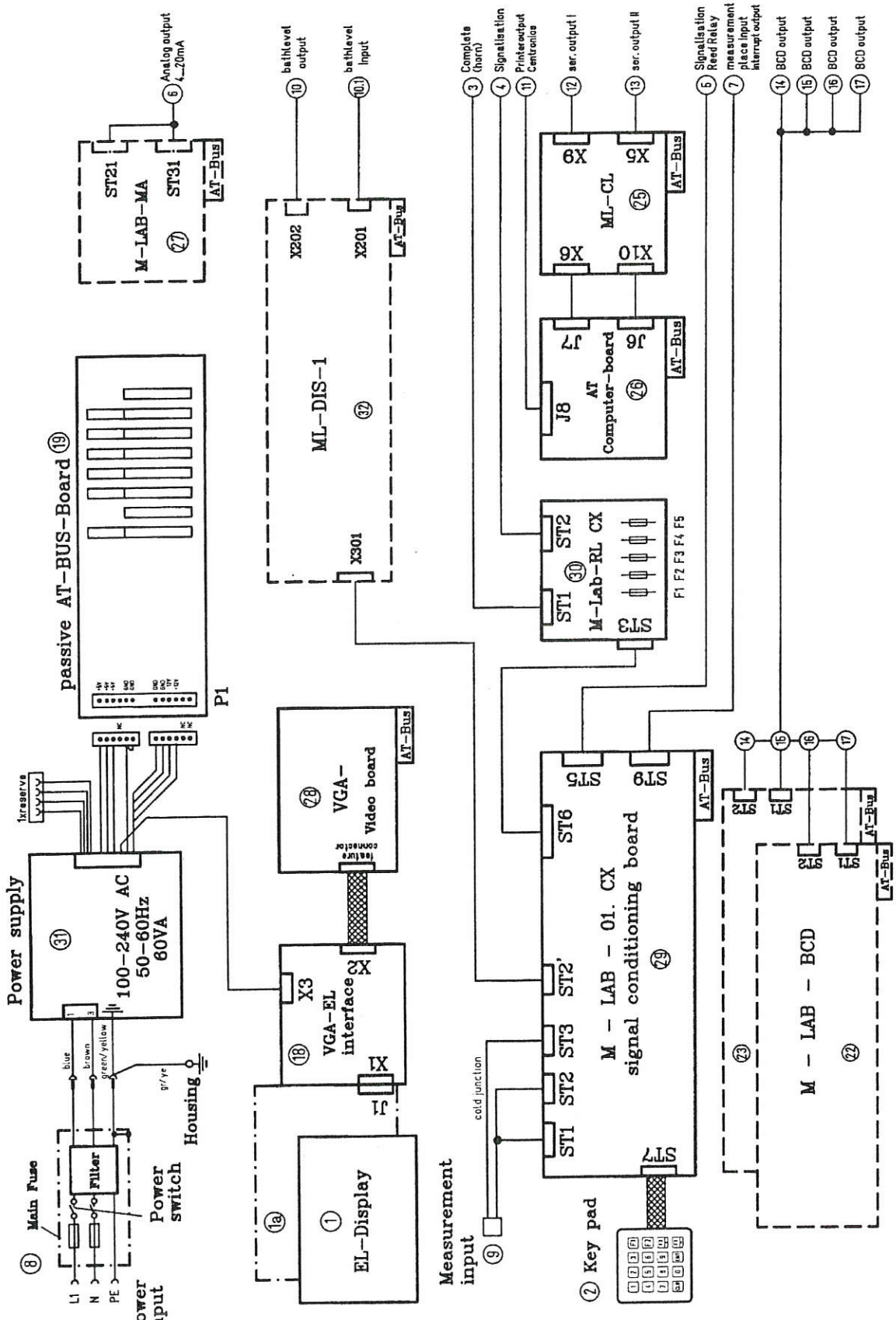
A	B	address	
set	set	340H – 343H	
free	set	344H – 347H	
set	free	348H – 34BH	2. mA Board
free	free	34CH – 34FH	1. mA Board (default setting)

4.10 ML-DIS-1 bathlevel

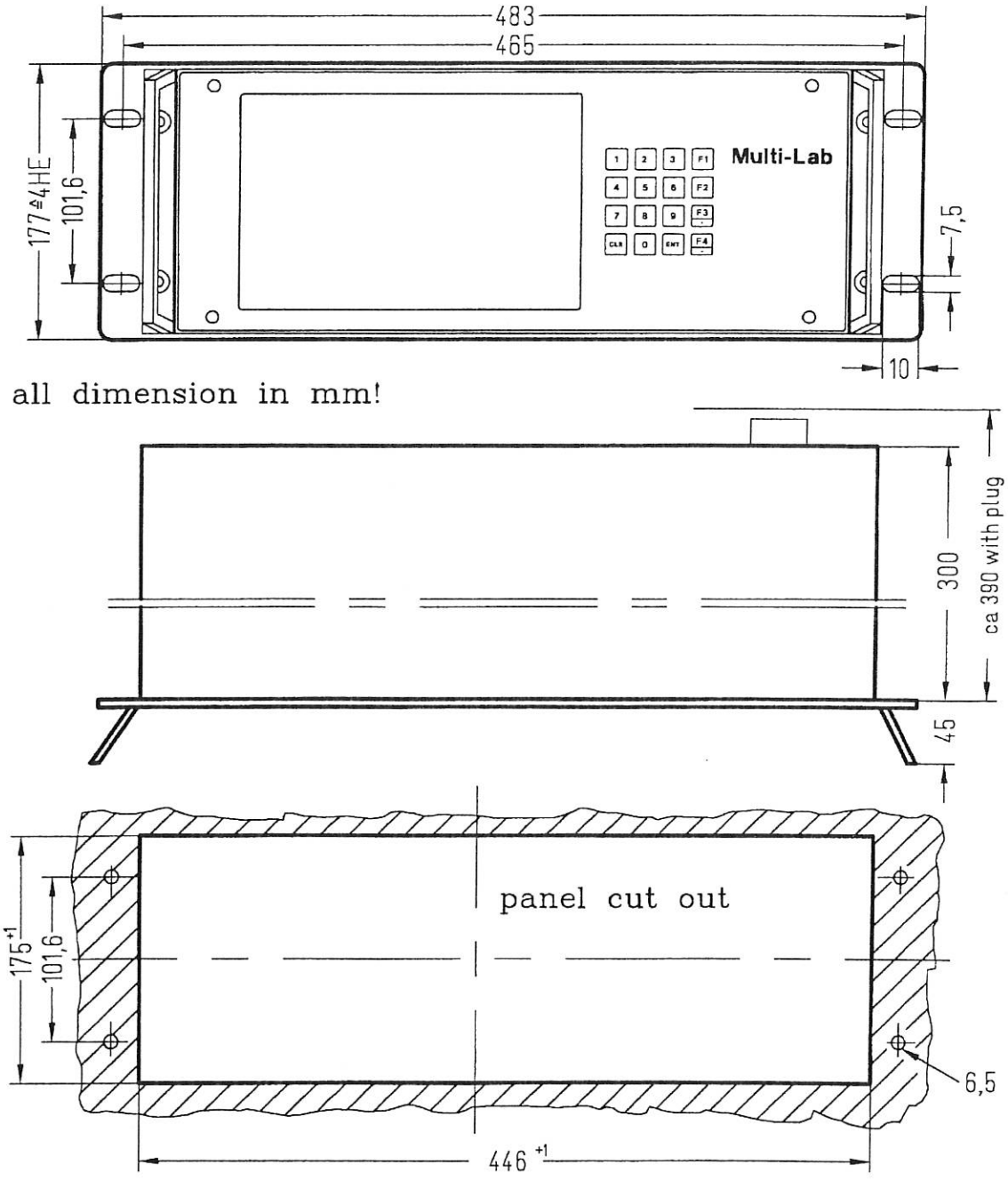


no jumper set
address 320

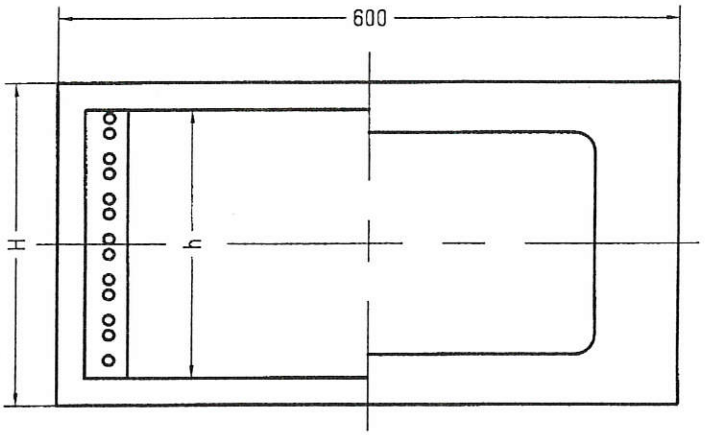
5 wiring diagram

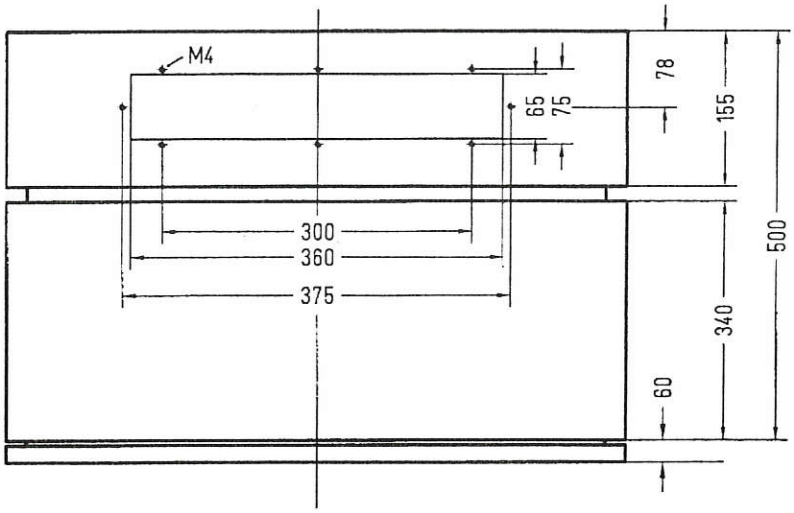


6 Housing dimension



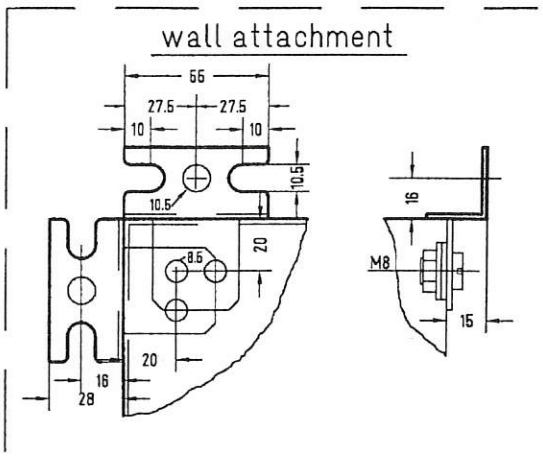
7 Dimension additional housing





	H	h
6 HU	320,5	266,5
9 HU	454	400
12 HU	587,5	533
15 HU	721	667

all dimension in mm!



Kalibrierschein / Calibration Certificate

AA-QS105A

Gerät: Instrument:	**Multi-Lab**		
Typ: type:	**Celox**		
Geräte Nr.: Instrum. no.:	**022340**		
Prüfer: Tester:	**241**	**Datum:** Date:	**25.10.2002**
Messstelle: Location:			
Auftraggeber: Customer:			
Auftrag Nr.: Order no.:			

	Temp. °C	**Temp. Liq. °C**
	Thermoelement Typ Thermocouple type	
	S R B ☒☐☐☐	**S R B** ☐☐☐☐
Soll-Wert Nominal-value	**Ist-Wert** Actual-value	**Ist-Wert** Actual-value
400	*400*	
500	*500*	
600	*600*	
700	*700*	
800	*800*	
900	*900*	
1000	*1000*	
1100	*1100*	
1200	*1200*	
1300	*1300*	
1400	*1400*	
1500	*1500*	
1600	*1600*	
1700	*1700*	

EMK EMF **mV**	
Soll-Wert Nominal-value	**Ist-Wert** Actual-value
-400	*400,0*
-300	*-300,0*
-200	*-199,8*
-100	*-99,7*
0	*0,0*
100	*99,7*
200	*199,8*
300	*299,9*
400	*400,1*

Kalibriergerät Calibration instrument	**AOIP PN 5201**
Kalibrierzeichen Calibration mark	**1407-HEN-H-02-02**

Kalibriergerät Calibration instrument	**AOIP PJN 5208**
Kalibrierzeichen Calibration mark	**1394-HEN-H-01-02**

Die Rückführbarkeit auf nationale Normale ist über ein DKD-kalibriertes Multimeter Typ PREMA 6048 sichergestellt.
The traceability to national standards with DKD-calibrated multimeter model PREMA 6048 is guaranteed.

Stempel
Stamp

HERAEUS ELECTRO-NITE GMBH & CO. KG
QUALITY CHECK

Zertifiziert nach Qualitätsmanagementsystem DIN EN ISO 9001 DQS Registr.-Nr. 3350

Heraeus Electro-Nite GmbH & Co. KG
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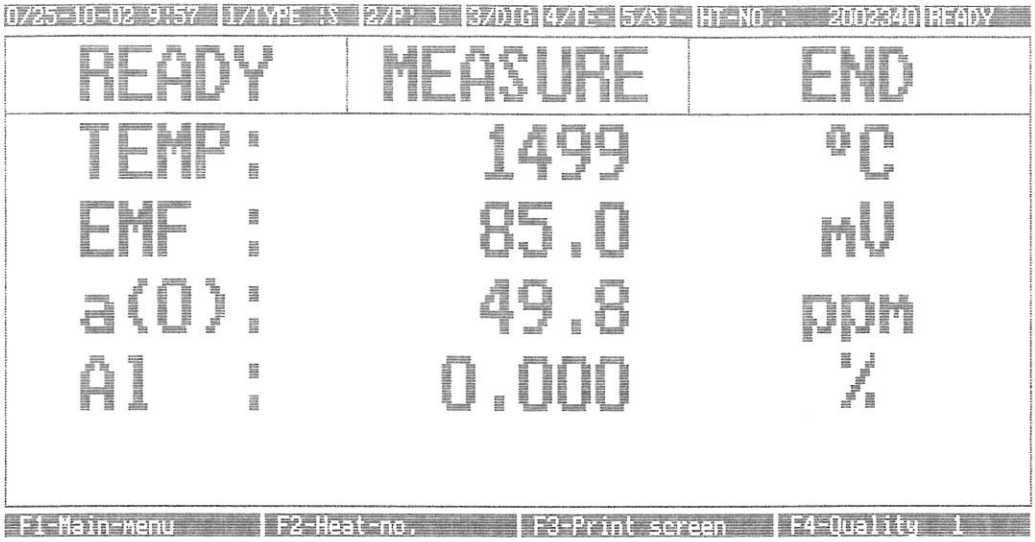
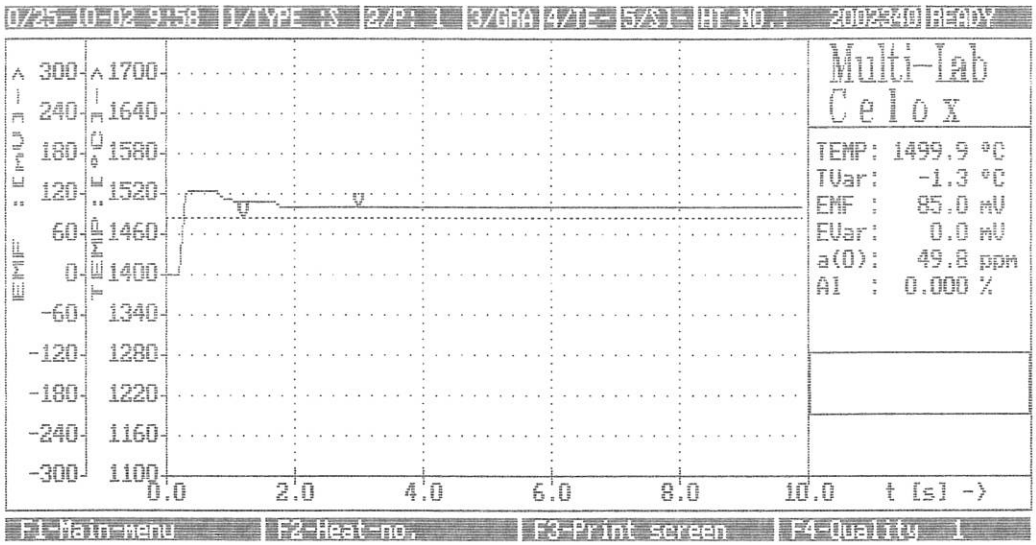
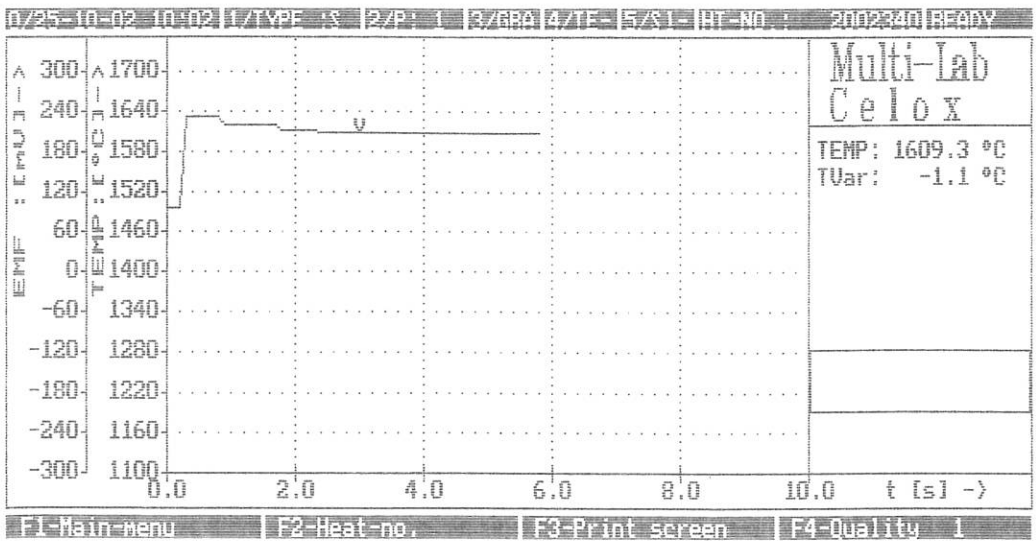
Electro-Nite


0/25-10-02 9:57
1/TYPE S
2/P: 1
3/DIG
4/TE-
5/S1-
HT-NO.: 2002340
READY
READY
MEASURE
END
TEMP: 1499 °C
EMF : 85.0 mV
a(O): 49.8 ppm
Al : 0.000 %
F1-Main-menu
F2-Heat-no.
F3-Print screen
F4-Quality 1


0/25-10-02 9:58
1/TYPE S
2/P: 1
3/GRA
4/TE-
5/S1-
HT-NO.: 2002340
READY
EMF : EmV
TEMP : E°C
300
240
180
120
60
0
-60
-120
-180
-240
-300
1700
1640
1580
1520
1460
1400
1340
1280
1220
1160
1100
0.0
2.0
4.0
6.0
8.0
10.0
t [s] ->
Multi-lab
Celox
TEMP: 1499.9 °C
TVar: -1.3 °C
EMF : 85.0 mV
EVar: 0.0 mV
a(O): 49.8 ppm
Al : 0.000 %
F1-Main-menu
F2-Heat-no.
F3-Print screen
F4-Quality 1


0/25-10-02 10:02
1/TYPE S
2/P: 1
3/GRA
4/TE-
5/S1-
HT-NO.: 2002340
READY
EMF : EmV
TEMP : E°C
300
240
180
120
60
0
-60
-120
-180
-240
-300
1700
1640
1580
1520
1460
1400
1340
1280
1220
1160
1100
0.0
2.0
4.0
6.0
8.0
10.0
t [s] ->
Multi-lab
Celox
TEMP: 1609.3 °C
TVar: -1.1 °C
F1-Main-menu
F2-Heat-no.
F3-Print screen
F4-Quality 1

Funktionsprüfung / Functional test **Multi-Lab** **AA-QS012E**

Gerät / Typ: Instrument / type:	**Multi-Lab Celox MLCX/EL**		
Geräte Nr.: Instrum. no.:	**022340**		
Programm Nr.: Programm no.:	**ML-Celox V2.14.00**		
Prüfer: Tester:	**241**	**Datum:** Date:	**25.10.2002**

1	**Kabelkonfektionierung** / Cable finishing		☒
2	**Kartenhalterung** / Board holder		☒
3	**Karten (richtiges Port)/ Kartensitz** / Boards (correct port) / Slot for board		☒
4	**Kartenführung / Kartensicherung** / Boards guiding / Boards safety		☒
5	**Vorverstärker (Version)** / Pre-Amplifier (version)	**M-LAB-01.V5**	
5.1	**Vorverstärker (Firmwareversion)** / Pre-Amplifier (firmware version)	**M-LAB Celox V5.08**	
5.2	**E-Quadrat-Prom prüfen** / Check E-prom		☒
5.3	**Stecker** / Plug		☒
5.4	**(MLCX) Zweite Temp.-Stiftwanne** / (MLCX) second temperature pin strip		☒
5.5	**Steckbrücken** / Jumper		☒
6	**AT Board Nr.** / AT board no.	**1000297000**	
6.1	**Steckbrücken / Stecker** / Jumper / plug		☒
6.2	**Brücke / serielle Programmierung** / Bridge/serial programming		☒
7	**Karte M-Lab CL** / Board M-Lab CL		☒
7.1	**Steckbrücken** / Jumper		☒
8	**Karte mA (1+2) (Celox)** / board mA (1+2) (Celox)		☐
9	**Karte BCD (1+2) (Celox)** / Board BCD (1+2) (Celox)		☐
10	**(MLQC) Vorverstärker 2 (Version)** / (MLQC) Pre-amplifier 2 (version)		☐
10.1	**(MLQC) Vorverstärker 2 (Firmwarevers.) /** (MLQC) Pre-amplifier 2 (firmware vers.)		☐
11	**ML-Dist (Version)** / ML-Dist (version)		☐
11.1	**ML-Dist (Firmwareversion) /** ML-Dist firmware version		☐
11.2	**ML-Dist Ein/Ausgang prüfen** / ML-Dist check input/output		☐
12	**Serielle Schnittstellen** / Serial interface		☒
12.1	**Testprogramm V24/20 mA** / Test programme V 24/20 mA		☒
13	**Schrauben** / Screws		☒
14	**Montageplatte** / Mounting panel		☒
15	**Typenschild** / Type label		☒
16	**Schutzleiter** / Protective conductor		☒
17	**Befestigung Netzteil** / Mounting power supply		☒
18	**Befestigung Bus-Platine** / Mounting BUS-Board		☒
19	**Display Nr.** / Display no.	**885740**	
20	**Displaybefestigung** / Mounting of Display		☒
21	**Displayeinstellung** / Setting of display		☒
22	**EMV-Filterscheibe und Folientastatur** / EMV-filter glass and keypad		☒
23	**Sicherungswert prüfen Netzeingang** / Check fuse power input	**M 2 A**	
24	**Stempel** / Stamp		☒
25	**Testprogramm ML** / Test programm ML		☒
26	**Datum / Uhrzeit** / Date / Time		☒

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E-Mail: info@electro-nite.de

					Geräte Nr.: Instrum. no.:	**022340**
27	**Sprache** / Language				**Englisch**	
28	**Meßorteinlesung** / Measurement place reading					☒
29	**Signalisierung (Temp./Analyse/Hupe)** / Signalisation (temp./analysis/horn)				**Solid-State-Relay**	☒
29.1	**Signalisierung / Sicherung** / Signalisation / Saftey fuse				**2,0 A FF**	
30	**Signalisierung Reed Relais** / Signalisation reed relay					☒
31	**Funktion Folientastatur** / Function Keypad					☒
32	**Formatieren RAM-Disk** / Format RAM-disk					☒
33	**Standard Prozess Parameter laden** / Load standard process parameter					☒
34	**Druckerausgang seriell, Daten/Graphik** / Printer output, serial data/graphic					☒
35	**Druckerausgang parallel, Daten/Graphik** / Printer output, parallel data/graphic					☒
36	**(MLCX) Testmessung Temp./Celox** / (MLCX) Test measurement Temp. / Celox					☒
37	**(MLQC) Testmessung Temp./Analyse/NOD** / (MLQC) Test measurement temp./analysis/NOD					☐
38	**Gespeicherte Messung prüfen** / Check memorized measurement					☒
39	**Chargen Nr. = Geräte Nr.** / Charge no. = Instrument no.					☒
40	**Dauermessung (Celox) Testmessung** / Continuous measurement (Celox)					☒
41	**Vorverstärker Test** / Pre-Amplifier test					☒
41.1	**Kalibrierung** / Calibration					☒
41.2	**Abgleich** / Adjustment					☒
41.3	**Kaltstelle** / Cold junction					☒
41.4	**ADC-watchdog**				**0**	
42	**Serielle Programmierung** / Serial programming					☒
43	**Potentiometer verlackt / Schrauben** / Potentiometer sealed / screws					☒
44	**Thermostreifen** / Thermo stripes					☒
45	**Potential (GND-PE)**					☒
46	**Sicherheitsüberprüfung** Safety check	**Norm** Standard **VDE 0701 Teil 1**				
46.1	**Testgerät** Test device	**ABB Metrawatt M 5013**	**Serien-Nr.:** Serial no.:	**M 3096 0438**		
46.2	**Schutzleiterwiderstand** Protective ground resistor				**0,14**	**Ohm**
46.3	**Ersatzableitstrom** Discharge current				**0,83**	**mA**
46.4	**Isolationswiderstand** Insulation resistor>				**> 20**	**MOhm**
47	**Leistungsaufnahme** / Power input				**65**	**VA**
48	**Betriebsspannung** / Operating voltage				**230**	**V**
49	**Frequenz** / Frequency				**50**	**Hz**
50	**Batteriespannung AT Board** / Battery voltage AT Board				**3,67**	**V**
50.1	**Batterie AT Board, Gerät an** / battery AT board, instrument on	(< 3 µA)			**2,40**	**µA**
50.2	**Batterie AT Board, Gerät aus** / battery AT board, instrument off	(< 30 µA)			**5,31**	**µA**
51	**Helligkeit** / Brightness				**30**	**Lux**
52	**Dokumentation** / Documentation		**Version:**	**V 2.14**		
53	**Ausdrucke** / Print-outs					☒
54	**Klimakammertest** / Climate chamber test					☒
55	**Zubehör** / Accessories					☒
56	**Bemerkungen:** / Remarks:					

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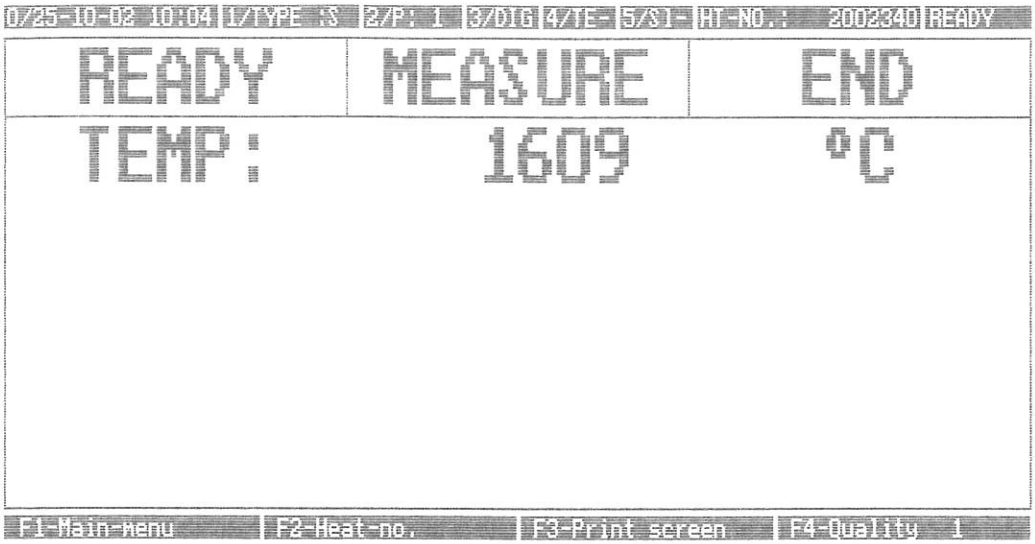
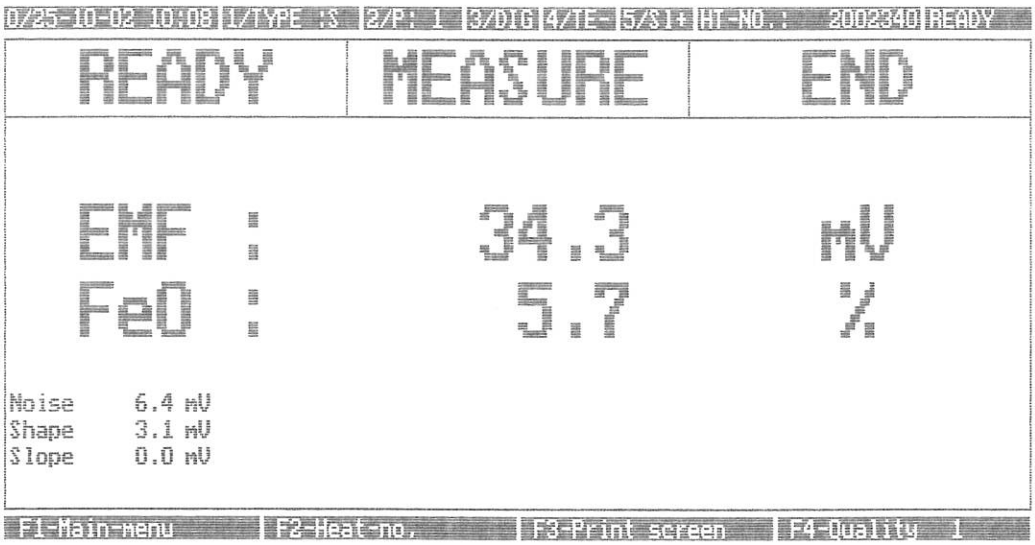
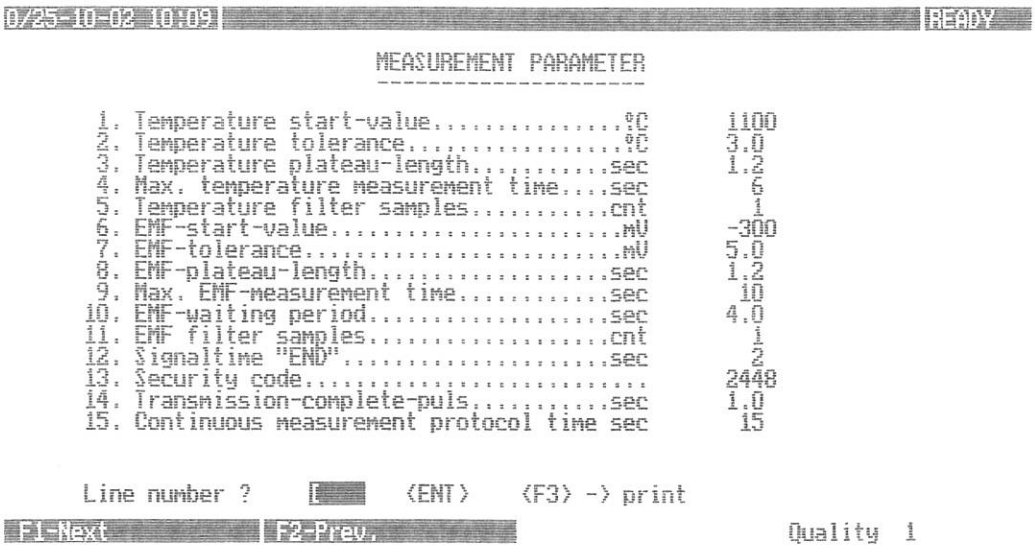

0/25-10-02 10:04 1/TYPE :S 2/P: 1 3/DIG 4/TE- 5/S1- HT-NO.: 2002340 READY
READY
MEASURE
END
TEMP:
1609
°C
F1-Main-menu
F2-Heat-no.
F3-Print screen
F4-Quality 1


0/25-10-02 10:08 1/TYPE :S 2/P: 1 3/DIG 4/TE- 5/S1+ HT-NO.: 2002340 READY
READY
MEASURE
END
EMF :
34.3
mV
FeO :
5.7
%
Noise 6.4 mV
Shape 3.1 mV
Slope 0.0 mV
F1-Main-menu
F2-Heat-no.
F3-Print screen
F4-Quality 1


0/25-10-02 10:09 READY
MEASUREMENT PARAMETER
1. Temperature start-value.....°C 1100
2. Temperature tolerance.....°C 3.0
3. Temperature plateau-length.....sec 1.2
4. Max. temperature measurement time....sec 6
5. Temperature filter samples.....cnt 1
6. EMF-start-value.....mV -300
7. EMF-tolerance.....mV 5.0
8. EMF-plateau-length.....sec 1.2
9. Max. EMF-measurement time.....sec 10
10. EMF-waiting period.....sec 4.0
11. EMF filter samples.....cnt 1
12. Signaltime "END".....sec 2
13. Security code..... 2448
14. Transmission-complete-puls,.....sec 1.0
15. Continuous measurement protocol time sec 15
Line number ? 1 <ENT> <F3> -> print
F1-Next
F2-Prev.
Quality 1

```
07/25-10-02 10:10                                                    READY

                        SLAC MEASUREMENT PARAMETER
                        --------------------------

  1. Maximum noise.....................mV        50.0
  2. Maximum slope.....................mV        5.0
  3. Maximum shape.....................mV        -5.0
  4. Delay to start....................sec       2.0
  5. Minimum slope to start measurement ...mV    3.0
  6. Max. SLAC measurement time.......sec        10.0

     Line number ?    [    ]   <ENT>    <F3> -> print
  F1-Next          F2-Prev.                          Quality  1
```

```
07/25-10-02 10:11                                                    READY

                          PROGRAM OPTIONS
                          ---------------

  1. Horn.....................................     ON
  2. "END"-signal at error-measurement.......     FLASHING
  3. Print mode...............................     HARDCOPY
  4. Auto print-out...........................     OFF
  5. Date mode................................     EUR
  6. Degree F or C............................     CELS
  7. Automatic element switching Celox.......     OFF
  8. Continuous measurement...................     OFF
  9. Language.................................     ENGLISH
 10. Data Logic  "Measurement Place".........     inverted
 11. Heat-no. + 1 at start of measurement ...     OFF
 12. Screen Saver............................      5 min
 13. Linearization...........................     IPTS68
 14. Stop on DIST CARD failure...............     OFF

     Line number ?    [    ]   <ENT>    <F3> -> print
  F1-Next          F2-Prev.                          Quality  1
```

```
07/25-10-02 10:12                                                    READY

                    Security code protection menue 1
                    --------------------------------

  1. Time/Date.....................Clr/0        OFF
  2. Element change................Clr/1        ON
  3. Place of measurement..........Clr/2        OFF
  4. Graphic/digital display switch...Clr/3     OFF
  5. Test measurement..............Clr/4        ON
  6. SLAC measurement..............Clr/5        ON
  7. Print measure results.........Clr/6        ON
  8. Initialize printer............Clr/7        ON
  9. Send serial data..(manual).....Clr/8       OFF
 10. Main menue.........................F1       OFF
 11. Chargen-Nr.........................F2       OFF
 12. Print..............................F3       OFF
 13. Quality............................F4       ON

     Line number ?    [    ]   <ENT>    <F3> -> print
  F1-Next          F2-Prev.                          Quality  1
```

```
07/25-10-02 10:12                                                READY

                    Security code protection menue 2
                    --------------------------------

  1. Process parameters.....................          ON
  2. Load standard parameters..............          ON
  3. Formulas...............................          ON
  4. RS-232 parameters......................          ON
  5. BCD-output.............................          ON
  6. 0/4..20mA output.......................          ON
  7. Spool out of results...................          OFF
  8. Hardware test..........................          ON
  9. Format RAM-Disk........................          ON
 10. Bath Level Option......................          ON




     Line number ?    [    ]   <ENT>    <F3> -> print

 F1-Next          F2-Prev.                          Quality  1
```

```
07/25-10-02 10:13                                                READY

                      Display parameter menu
                      ----------------------

  1. Temperature-display start-value.......°C       1100
  2. Temperature-display end-value.........°C       1700
  3. EMF-display start-value...............mV       -300
  4. EMF-display end-value.................mV       300
  5. SLAC display start-value..............mV       -300
  6. SLAC display end-value................mV       300




     Line number ?    [    ]   <ENT>    <F3> -> print

 F1-Next          F2-Prev.                          Quality  1
```

```
0/25-10-02 10:15                                                    READY

                        SERIAL OUTPUT RS-232     1
                        --------------------

 1. Baudrate.................................     9600
 2. Databits.................................     8
 3. Stopbits.................................     1
 4. Parity...................................     Even parity
 5. Protocol.................................     3964R with BCC
 6. CTS-control ( busy / ready ).............     OFF
 7. Datatelegrams............................     STX (--) ETX
 8. Decimal..................................     point
 9. Programming Datatelegram.................
10. Transfer of measurement samples..........     OFF
11. Time with seconds........................     OFF


Line number ?     [    ]    (ENT)    (F3) -> print

F1-Next          F2-Prev.
```

```
0/25-10-02 10:16                                                    READY

                        SERIAL OUTPUT RS-232     2
                        --------------------

 1. Baudrate.................................      300
 2. Databits.................................     7
 3. Stopbits.................................     2
 4. Parity...................................     Even parity
 5. Protocol.................................     No protocol
 6. CTS-control ( busy / ready ).............     OFF
 7. Datatelegrams............................     Deltaprint
 8. Decimal..................................     comma
 9. Programming Datatelegram.................
10. Transfer of measurement samples..........     OFF
11. Time with seconds........................     OFF


Line number ?     [    ]    (ENT)    (F3) -> print

F1-Next          F2-Prev.
```