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Metrohm Sample Processors

838 Advanced Sample Processor

Technical Reference

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1 The Metrohm Remote Control Language

1.1 General rules

Metrohm instruments have an extensive remote control facility that allows full control of the instrument via the RS 232 interface, i.e. the instrument can receive data from an external controller or send data to an external controller. C_R and L_F are used as terminators for the data transfer. The instrument sends 2xC_R and L_F as termination of a data block, to differentiate between a data line which has C_R and L_F as terminators. The controller terminates its commands with C_R and L_F. If more than one command per line is sent by the controller, ";" is used as a separator between the individual commands.

The data are grouped logically and easy to understand. Thus e.g., for the selection of the dialog language, the following must be sent

&Config.**A**ux.**L**anguage **"english"**

whereby it is sufficient to only transmit the boldface characters, thus:

&C.A.L "english"

The quantities of the commands above are:

Config configuration data
Aux auxiliaries, various data
Language setting the dialog language

The data are hierarchically structured (tree form). The quantities that occur in this tree are called **objects** in the following. The dialog language is an object which can be called up with the

&Config.**A**ux.**L**anguage command.

If one is in the desired location in the tree, the value of the object can be queried.

&Config.**A**ux.**L**anguage **$Q** Q means Query

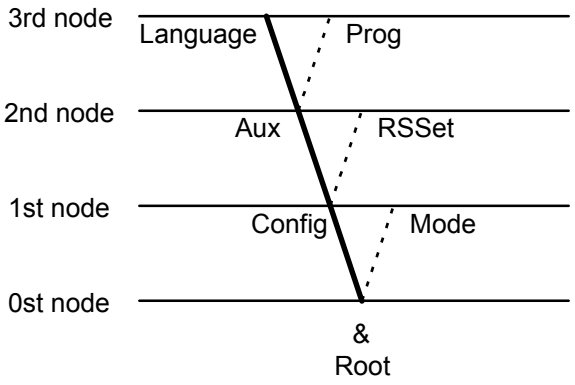
The query command $Q initiates the issuing of the value on the instrument and the value emission is triggered. Entries which start with $, trigger something. They are thus called **triggers**.

Values of objects can not only be queried, they can also be modified. Values are always entered in quotes, for example:

&Config.**A**ux.**L**anguage **"english"**

1.2 Call up of objects

An excerpt from the object tree is represented below:



Rules	Example
The root of the tree is designated by &.	
The branches (levels) of a tree are marked with a dot (.) when calling up an object.	
When calling up an object, it is sufficient to give only as many letters as necessary to uniquely assign the object. If the call is not unequivocal, the first object in the series will be recognized.	Calling up the dialog language **&C**onfig.**A**ux.**L**anguage or **&C.A.L**
Upper- or lowercase letters may be used.	**&C.A.L** or **&c.a.l**
An object can be assigned a value. Values are signified at the beginning and end by quotes ("). They may contain up to 24 ASCII characters.	Entering the dialog language: **&C.A.L"english"**
Numerical values can contain up to 6 digits, a negative sign, and a decimal point. Numbers with more than 6 characters are not accepted; more than 4 decimal places are rounded off. For numbers <1, it is necessary to enter leading zeros.	correct entry of numbers: **"0.1"** incorrect entry of numbers "1,5" or "+3" or ".1"
The current object remains until a new object is called.	entry of another dialog language: **"deutsch"**
New objects can be addressed relative to the old object: A **preceding dot** leads **forwards** to the next level in the tree.	From the root to node 'Aux': **&C.A** Forward from node 'Aux' to 'Prog': **.P**
More than one preceding dot leads one level **backwards** in the tree. n node backwards require n+1 preceding dots.	Jump from node 'Prog' to node 'Aux' and select a new object 'Language' at this level: ..**L**
If you must jump back to the root, enter a preceding &.	Change from node 'Language' via the root to node 'Mode': **&M**

1.3 Triggers

Triggers initiate an action on the instrument, for example, starting a process or sending data. Triggers are marked by the introductory symbol $.

The following triggers are possible:

$G	**G**o	Starts processes, for ex. starting the mode run or setting the RS 232 interface parameters
$S	**S**top	Stops processes
$H	**H**old	Holds processes
$C	**C**ontinue	Continues processes after Hold
$Q	**Q**uery	Queries all information from the current node in the tree forward up to and including the values
$Q.P	**P**ath	Queries the path from the root of the tree up to the current node
$Q.H	**H**ighest Index	Queries the number of son nodes of the current node
$Q.N"i"	**N**ame	Queries the name of the son node with index i, i = 1 - n
$D	**D**etail-Info	Queries the detailed status information
$U	q**U**it	Aborts the data flow of the instrument, for example, after $Q

The triggers $G and $S are linked to particular objects, see the summary table.

All other triggers can be used at any time and at all locations on the object tree.

Examples:

Querying the value of the baud rate: **&C**onfig.**R**SSet.**B**aud **$Q**
Querying all values of the node "RSSet": **&C**onfig.**R**SSet **$Q**
Querying the path of the node "RSSet": **&C**onfig.**R**SSet **$Q.P**
Start mode: **&M**ode **$G**
Querying the detailed status: **$D**

1.4 Status messages

In order to have an efficient control by an external control device, it must also be possible to query status conditions; they provide information on the status of the instrument. The trigger $D initiates output of the status. Status messages consist of the global status, the detailed status and eventual error messages, e.g. $S.Mode.SET;E26. The global status informs on the activity of the process, while the detailed status conditions show the exact activity within the process.

The following **global status conditions** are possible:

$G Go:	The instrument is executing the last command.
$H Hold:	The instrument has been held ($H, key <meas/hold> or by an error which effects the hold status)
$C Continue:	The instrument has been restarted actively after hold
$R Ready:	The instrument has executed the last command and is ready
$S Stop:	A process has been aborted in an "unnatural manner". e.g. stopped or aborted because there was an error.

1.5 Detailed status conditions

Status conditions of the global $G:

$G.Mode.XXX .Inac:	instrument at the beginning or at the end of a mode.
.Run:	instrument in the XXX mode, running.
$G.Assembly.Fill:	Buret in filling process
$G.Assembly.Prep:	Preparing a dosing unit
$G.Assembly.Empty:	Emptying a dosing unit

Manual modes:

$G.Manual.DOSING	Manual dosing
$R.Manual.DIS	Manual distribution

Status conditions of the global $H:

The status message of the action which has been held appears.

Status conditions of the global $C:

The status conditions of the global $C are identical with the ones of the global status $G. They appear when the process has been restarted actively from the status "Hold" ($C, key <CONTINUE/HOLD> or automatically after elimination of an error).

Status conditions of the global $R:

$R.Mode.XXXX.Inac: instrument in the XXXX mode, inactive.

Status conditions of the global $S:

$S.Mode.XXXX.Inac: The instrument gives the status from which it has been stopped. The detailed status information is therefore identical to those of the global status $G.

1.6 Error messages

Error messages are added to the status messages and separated from them by the sign ";".

This list of error messages applies to all instruments provided with the Metrohm remote control language.

E1	Incorrect program check sum
E2	RAM read/write error
E3	RAM lost data (battery)
E4	Timer interrupt for multi-tasking is missing
E5	RS232 module test error
E6	Defective real time clock or defective EBUS or RS232 read/write error
E7	Display read/write error
E8	Card read/write error. Exit: Send new command.
E9	Wrong card, i.e. memory card from an other instrument or card has been removed/inserted during the inquiry. Exit: Replace card and send new command.
E10	The card has lost data. Exit: Replace card and end new command.
E11	EEPROM Error
E12	EBUS Error Slave 1. Set address switch correctly!
E13	EBUS Error Slave 2
E14	Remote Box communication error
E18	Card battery low (it is between 2.37...2.64 V). Exit: Send new command. Change battery.
E19	Faulty RAM test
E20	Check exchange unit. Exit: Mount Exchange Unit (properly) or &m $S.
E21	Check electrode, short circuit. Replace electrode if necessary. Exit: Rectify fault or &m $S.
E22	Check electrode, break. See above. Exit: Rectify fault or &m $S.
E23	Division by zero. Exit: The error message disappears on next startup or on recalculation.
E24	Check drive unit. Exit: Connect drive unit (correctly) or &m $S.
E26	Manual stop. Exit: The error message disappears on next startup.
E27	Stop V reached in SET, STAT, DOS or DOC. Exit: The error message disappears on next startup.
E28	Wrong object call up Exit: Send correct path for object. Start path at root.
E29	Wrong value or no value allowed. Exit: Send correct value or call up new object.

E30 Wrong trigger, this trigger is not allowed or carrying-out of action not possible.
Exit: Send correct trigger (exception: $D) or call up new object.

E31 Command is not possible in active status. Repeat command in inactive status.
Exit: Send new command.

E32 Command is not possible during titration. Repeat command during the conditioning phase or in inactive status.
Exit: Send new command.

E33 Value has been corrected automatically.
Exit: Send new command.

E34 instrument at the end of the titration and sample data is edited; the instrument at rest or editing during filling.
Exit: &m $S.

RS receive errors:

E36 Parity
Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E37 Framing error
Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E38 Overrun error. At least 1 character could not be read.
Exit: <QUIT>

E39 The internal working-off buffer of the instrumentis full (>82 characters).
Exit: <QUIT>

RS send errors:

E40 DSR = OFF, no proper handshake for more than 1 s

E41 DCD = ON, is the receiver switched on and ready to receive?

E42 CTS=OFF, no proper handshake for more than 1 s.
Exit: <QUIT> Is the receiver switched on and ready to receive?

E43 The transmission of the instrumenthas been interrupted with XOFF for at least 6 s.
Exit: Send XON or <QUIT>

E44 The RS parameters are no longer the same for both devices

E45 The receive buffer of the instrument contains an incomplete command (L_F missing). Sending from the instrumentis therefore blocked.
Exit: Send L_F or <QUIT>.

E120 Overrange of the primary measured value (pH, U, Ipol, Upol or T with MEAS T). The secondary measured value (temperature) may be instable as well.
Exit: Correct error or &m $S.

E121 Measuring point list overflow (more than 500 measuring points).
Exit: The error message disappears on next startup.

E122 EP overflow.
Exit: The error message disappears on next startup or on recalculation.

E123 Missing EP for calculation.
Exit: The error message disappears on next startup or on recalculation.

E124 Number of EP does not correspond with the set windows.
Exit: The error message disappears on next startup or on recalculation.

E125 Missing fix EP for calculation, has not been defined.
Exit: The error message disappears on next startup or on recalculation.

E126 Fix-EP outside of measuring point list.
Exit: The error message disappears on next startup or on recalculation.

E128 No new mean.
Exit: The error message disappears on next startup or on recalculation.

E129 No new common variable, old value remains.
Exit: The error message disappears on next startup or on recalculation.

E130 Wrong sample. For SET, KFT or DOC with preset titration direction the first measured value lies behind the endpoint.
Exit: The error message disappears on next startup.

E131 No EP set for SET, STAT.
Exit: The error message disappears on next startup.

E132 Silo empty and it has been started with open silo or empty silo has been opened.
Exit: Send a silo entry.

E133 Silo full.
Exit: Send new command.

E134 No method. A method, which is required from the silo memory or in TIP, does not exist.
Exit: The error message disappears on next startup.

E135 Check temp.sensor in MEAS T or with activated temperature monitoring. Temp. sensor may not be connected.
Exit: Correct error or &m $S.

E136 Same buffer in CAL. Measured value of the second buffer differs less than 6 mV from the measured value of the first buffer.
Exit: Rectify error or &m $S.

E137 XXX Bytes are missing so that the method, the silo line could not be stored or not enough RAM for running TIP.
Exit: Send new command.

E149 Rate missing for calculation.
Exit: The error message disappears on next start or on recalculation.

E150 Number of rates does not agree with the set windows or the mean rate C80 could not be calculated.
Exit: The error message disappears on next start or on recalculation.

E151 Fix volume missing for calculation.
Exit: The error message disappears on next startup or on recalculation.

E155 No new silo result (C24 or C25).
Exit: The error message disappears on next start or on recalculation.

E157 No sequence defined in TIP.
Exit. The error message disappears on next start.

E158 A second TIP has been called up in TIP.
Exit: The error message disappears on next start.

E160 No new temporary variable.
Exit: The error message disappears on next start.

E161 Measurement range of the secondary measured value (temperature) exceeded. The primary measured value (pH, U, Ipol, Upol) can also be unstable.
Exit: Rectify error or &m $S.

E162 No ramp end set in DOC.
Exit: The error message disappears on next start or &m $S.

E166 Save lines is "OFF" although a submethod of TIP includes an assignment to C24 or C25.
Exit: The error message disappears on next start. Attention: The data of this sample will not be stored.

E167 Rate too high in DOS. No dispensing possible with the Exchange Unit currently mounted.
Exit: The error message disappears on next start or &m $S.

E170 Fix time missing for calculation.
Exit: The error message disappears on next start or on recalculation.

E171 Rate too low in DOS. No dispensing possible with the Exchange Unit currently mounted.
Exit: The error message disappears on next start or &m $S.

E172 In TIP or DOS a QuickMeas was started, without defining a measuring quantity.
Exit: The error message disappears on next start or &Mode.QuickMeas $S.

E173 The warning interval of the internal buret D0 called.
Exit: Execute prep &a.b.p $G or start next method.

E174 The warning interval of the external buret D1 called.
Exit: Execute prep &a.b.p $G or start next method.

E175 The warning interval of the external buret D2 called.
Exit: Execute prep &a.b.p $G or start next method.

E176 The function &Assembly.Buret.Prep or &Assembly.Buret.Empty was interrupted manually.
Exit. The error message disappears on next start.

E177 Accessing to the memory card, the card was not (properly) inserted.
Exit. The error message disappears on next start.

E178 The date of changing the battery of the card is expired.
Exit. The error message disappears on next start.

E180 Memory card write-protected.
Exit: Send new command.

E181 Memory card not formatted.
Exit: Send new command.

E182 Memory card not accessible.
Exit: Send new command.

E183 A directory with the same name exists already on the memory card.
Exit: Send new command.

E184 Measured value below lower limit.
Exit: The error message disappears when again within the limits or &m $S.

E185 Measured value above upper limit.
Exit: The error message disappears when again within the limits or &m $S.

E186	Temperature below lower limit. Exit: The error message disappears when again within the limits or &m $S.
E187	Temperature above upper limit. Exit: The error message disappears when again within the limits or &m $S.
E188	Rate below lower limit. Exit: The error message disappears when within the limits or &m $S.
E189	Rate above upper limit. Exit: The error message disappears when within the limits or &m $S.
E190	Add Water
E191	Blank error
E192	Generator electrode
E193	Indicator electrode
E194	Sample unfit
E195	Water R
E196	Result out of limits
E197	Weighing out of limits
E198	Validation interval exceeded
E199	Service date reached
E200	Invalid instrument adjustment (default value)
E201	Function error of Sample Changer/Processor
E202	Function error of dosing drive
E203	No oven temperature
E204	No external dosing unit
E205	Calibration interval expired
E206	Gas flow too high
E207	Error list full
E208	Timeout reached
E209	Instrument temperature too high (>60°C)
E210	Check Pt sensor
E211	Short circuit on Pt 100/1000
E212	Remote-Box transfer error
E213	Remote-Box keyboard timeout
E214	Remote-Box, check parameter

2 The remote control tree

2.1 Overview

The remote control tree contains the following main branches:

&	**Root**
├.Mode	Method parameters
├.Config	Instrument configuration
├.Info	Current data
├.Setup	Instrument setup
├.UserMeth	User-defined methods
├.Assembly	Instrument components
└.Diagnosis	Instrument diagnosis

The following tables list all objects of the remote control tree. For the unambiguous designation of the objects, the underlined characters suffice. The meaning of the individual object is described here in brief, for more detailed information please refer to 'Instructions for use'. The default values of the objects are printed in boldface.

2.2 &Mode – Method parameters

Object	*Meaning*	*Entry range/Selection*
&Mode	**Mode** Start ($G) or stop ($S) the current method. Interrupt with $H (hold), resume with $C (continue).	$G; $S; $H; $C
.Method	Name of current method (******** stands for a blank method)	read only (8 characters)
.SmplNo	Number of samples to be processed * = infinite number of samples (Processing has to be stopped with &M;$S or <STOP>) rack = (Number of rack positions – number of special beakers defined).	1...999, *, **rack**
.StartSeq	**Start sequence** Commands to be executed before the sample series	
.1	Index node 1 of the start sequence	
.Cmd	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF, PUMP, PERISTALTIC, VALVE, DOS, SCAN, CTRL, WAIT, RACK
.*		
:		
	The **&Mode.StartSeq.*.Cmd** *node defines the command of the indexed command line in a start sequence. The introduction of a command appends the according sub-branch from &Assembly to the index node.* *Example:* *&Mode.StartSeq.1.Cmd("MOVE")* *⇒ &Mode.StartSeq.1.Move.Target("1")* *⇒ &Mode.StartSeq.1.Move.Position("sample")* *A* **NOP***-entry cuts the appended sub-branch from the index node. Each entry at the end of a sequence appends a new node &Mode.StartSeq.*.Cmd("NOP").*	
:		
.99	End of start sequence	**NOP**
.SampleSeq	**Sample sequence** Commands to be executed with each sample	
.1	Index node 1 of the sample sequence	
.Cmd	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF, PUMP, DOS, SCAN, CTRL, WAIT, RACK
.*		
:		
	The **&Mode.SampleSeq.*.Cmd** *node defines the command of the indexed command line in a sample sequence. The introduction of a command appends the according sub-branch from &Assembly to the index node.* *See also the descriptions of the Start sequence.*	
:		
.99	End of sample sequence	**NOP**
.FinalSeq	**Final sequence** Commands to be executed after the sample series	
.1	Index node 1 of the final sequence	
.Cmd	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF, PUMP, DOS, SCAN, CTRL, WAIT, RACK
.*		
:		
	The **&Mode.FinalSeq.*.Cmd** *node defines the command of the indexed command line in a final sequence. The introduction of a command appends the according sub-branch from &Assembly to the index node.* *See also the descriptions of the Start sequence.*	
:		

:└.99	End of final sequence	**NOP**
:		
├.Changer	**Sample changer settings**	
│ ├.RackName	Rack name, forces the use of the defined rack with the current method (blank = any rack).	**blank,** 10 ASCII characters
│ ├.L1Rate	Lift rate of tower 1 (in mm/second)	5...**25** mm/s
│ ├.L2Rate	Lift rate of tower 2 (in mm/second)	5...**25** mm/s
│ ├.ShRate	Shift rate of the rac k in angular degrees/sec	3...**20** °/s
│ ├.ShDir	Shift direction of the rack (ascending or descending rack positions; auto. means automatic choice of the shortest path)	+,-,**auto**
│ ├.Rotincr	Rotation increment for `MOVE +/-rotate`	0.00…5.00…359.99°
│ ├.Sw1Rate	Swing head 1 rate in angular degrees/sec	10…55 °/s
│ ├.Sw2Rate	Swing head 2 rate in angular degrees/sec	10…55 °/s
│ ├.Swincr	Swing increment for `MOVE +/-swing`	0.00…10.00…180.00°
│ └.ModeSample	Reaction on missing sample beaker. (MOVE = next sample beaker will be chosen regarding the recent SAMPLE command, display = display warning.)	**MOVE**, display
├.StirRates	**Stirrer rates**	
│ ├.T1	Rate of stirrer on tower 1	1...**3**...15
│ ├.T2	Rate of stirrer on tower 2	1...**3**...15
│ ├.MSB1	Rate of MSB stirrer 1	1...**3**...15
│ ├.MSB2	Rate of MSB stirrer 2	1...**3**...15
│ └.MSB3	Rate of MSB stirrer 3	1...**3**...15
├.DosimatSet	**Dosing settings**	
│ ├.DosUnitNo	Dosing drive address	**1**...3
│ ├.1	Drive selector	
│ :├.DosRate	Dosing rate	0.01...160 ml/min, **max.**
│ ├.FillRate	Filing rate	0.01...160 ml/min, **max.**
│ ├.DosTube	Dosing outlet 1	**1**...4
│ ├.DosTube2	Dosing outlet 2	**1**...4
│ ├.FillTube	Filling inlet	1...**2**...4
│ ├.ExchTube	Rinsing inlet on exchanging buret unit	1...**2**...4
│ ├.PrepTube	Dosing outlet in preparing cycle	**1**...4
│ ├.EmptyTube	Air inlet for emptying	1...**4**
│ ├.CockMove	Cock direction of Dosino auto = shortest path for cock rotation asc/desc = fixed cock rotation direction not over = cock will not rotate over protected port	**auto**, asc., desc., not over
│ └.NotOver	Dosino port to be protected	1...**4**
│ :		
│ └.3	up to dosing drive 3	
├.TimeoutSet	**SCAN timeout settings**	
│ ├.STime	SCAN Timeout in min.	0…999, **off**
│ └.SAction	Action after timeout	**error**, cont.
└.ManStop	**Actions after manual stop**	
├.RemCtl	Remote command	STOP device1, STOP device2, STOP device*, 14 x 1,0 or * (bin)
├.RSCtl	Command via RS232 interface	&M;$S, 14 ASCII characters
├.Peristaltic	Pump state	on, off, **cont.**

├.Pumps	Pumps states	on, off, **cont.**
├.StirT1	Stirrer of tower 1	on, off, **cont.**
├.StirT2	Stirrer of tower 2	on, off, **cont.**
├.StirMSB1	MSB Stirrer 1	on, off, **cont.**
├.StirMSB2	MSB Stirrer 2	on, off, **cont.**
└.StirMSB3	MSB Stirrer 3	on, off, **cont.**

2.3 &Configuration

Object	Meaning	Entry range/Selection
&Config		
.Aux	**Basic settings**	
.Language	Dialog language	**english**; deutsch; francais; español
.Contrast	Display contrast	0..**3**..7
.Beeper	Beeper	off; **on**
.ExtStart	Enable external Remote start	**off**; on
.TimeMeter	**Working time meter**	
.Elapsed	Working hours elapsed	read only
.Warning	Time limit	**off**, 1…99999 h
.DevName	Device label	8 ASCII characters
.Prog	Program version	5.838.013 (read only)
.AutoReset	En/Disable rack reset on 'Start'	off; **on**
.RamInit	Ram initialization on 'Start'	**off**; on
.Tower1	**Settings for tower 1**	
.MaxLift	Maximum stroke path	0...**235** mm
.BeakRad	Min. required beaker radius	1.0…100.0 mm, *
.SwingHead	**Swing head settings of tower 1**	
.RinsePos	Lift position for rinsing in ext. position	**0**…235 mm
.SwingPos	Lowest lift position for moving the swing head	**0**…235 mm
.Ext1Pos	Swing angle for external position 1	0…**117.00**…(max. angle, see p. 19)
.Ext1Height	Working lift height of ext. position 1	**0**…235 mm
.Ext2Pos	Swing angle for external position 2	0…**117.00**…(max. angle)
.Ext2Height	Working lift height of ext. position 2	**0**…235 mm
.Ext3Pos	Swing angle for external position 3	0…**117.00**…(max. angle)
.Ext3Height	Working lift height of ext. position 3	**0**…235 mm
.Ext4Pos	Swing angle for external position 4	0…**117.00**…(max. angle)
.Ext4Height	Working lift height of ext. position 4	**0**…235 mm
.Tower2	**Settings for tower 2**	
.MaxLift	Maximum stroke path	0...**235** mm
.BeakRad	Min. required beaker radius	1.0…100.0 mm, *
.SwingHead	**Swing head settings of tower 2**	
.RinsePos	Lift position for rinsing in ext. position	**0**…235 mm
.SwingPos	Lowest lift position for moving the swing head	**0**…235 mm
.Ext1Pos	Swing angle for external position 1	0…**117.00**…(max. angle, see p. 19)
.Ext1Height	Working lift height of ext. position 1	**0**…235 mm
.Ext2Pos	Swing angle for external position 2	0…**117.00**…(max. angle)
.Ext2Height	Working lift height of ext. position 2	**0**…235 mm
.Ext3Pos	Swing angle for external position 3	0…**117.00**…(max. angle)
.Ext3Height	Working lift height of ext. position 3	**0**…235 mm
.Ext4Pos	Swing angle for external position 4	0…**117.00**…(max. angle)
.Ext4Height	Working lift height of ext. position 4	**0**…235 mm
.RackDef	**Rack definitions**	
.RecallRack	Load rack defninitions	**$G**
.Name *	Rack name	6.2041.440,.....
.Code	Rack code	**010100**(b)...111111(b)
.WorkT1	Working lift height at tower 1	**0**...235 mm

├.WorkT2	Working lift height at tower 2	**0**...235 mm
├.RinseT1	Rinsing lift heigth at tower 1	**0**...235 mm
├.RinseT2	Rinsing lift heigth at tower 2	**0**...235 mm
├.ShiftHT1	Shifting lift heigth at tower 1	**0**...235 mm
├.ShiftHT2	Shifting lift heigth at tower 2	**0**...235 mm
├.Special1	Special lift position at tower 1	**0**...235 mm
├.Special2	Special lift position at tower 1	**0**...235 mm
├.BeakRad	Beaker radius of sample positions	1.0…100.0, ***** * means no check
├.Sensor	Type of beaker sensor	Tower,SwingH, **none**
├.Offset	Rotational offset	**0**...±5.00°
├.PosTab	**Rack position table**	
: ├.Num	Number of rack positions	**1**...999
├.1	Rack position 1	
├.Angle	Rotation angle for rack position 1	**0**...359.90°
└.Radius	Rack radius for rack position 1	**0**...250.00 mm
:	:	
└.999	Rack position 999	
├.Angle	Rotation angle for rack position 999	**0**...359.90°
└.Radius	Rack radius for rack position 999	**0**...250.00 mm
: :		
└.SpezBeak	**Special beakers**	
├.SpezBeakNo	Special beaker number	**1**…16
├.1	Special beaker 1	
├.Pos	Rack position	**0**…number of rack positions
├.WorkT1	Working lift height for tower 1	**0**...235 mm
├.WorkT2	Working lift height for tower 2	**0**...235 mm
├.BeakRad	Actual beaker radius	1.0…100.0, ***** * means no check
└.Sensor	Beaker sensor type	**Tower**, SwingH, none
:		
└.16	Special beaker 16	
├.Pos		
├.WorkT1	Working lift height for tower 1	**0**...235 mm
├.WorkT2	Working lift height for tower 2	**0**...235 mm
├.BeakRad	Actual beaker radius	1.0…100.0, ***** * means no check
: └.Sensor	Beaker sensor type	**Tower**, SwingH, none
├.StoreRack	Save rack definition	$G
│ └.Name	Rack name	10 ASCII characters
├.DeleteRack	Delete rack definition	$G
│ └.Name	Rack name	10 ASCII characters
├.DelAll	Delete all rack definitions	$G
└.List	List of available rack definitions	
├.1	Rack 1 …	
: ├.Name	Rack name	10 ASCII characters
└.Bytes	Size of rack table	read only
:		
└.32	… rack 32	
├.Name	Rack name	10 ASCII characters
└.Bytes	Size of rack table	read only
├.WetPart	**Buret definitions**	
├.WetPartNo	Selection of buret unit	**1**...3
*		
├.1	Settings of port 1	
: ├.MaxRate	Maximum feeding rate	0.01...**160** mL/min

├.Length	Tube length	0...**1000**...30000 mm
└.Diameter	Tube diameter	0...**2**...20 mm
├.2	Settings of port 2	
├.MaxRate	Maximum feeding rate	0.01...**160** mL/min
├.Length	Tube length	0...**250**...30000 mm
└.Diameter	Tube diameter	0...**2**...20 mm
├.3	Settings of port 3	
├.MaxRate	Maximum feeding rate	0.01...**160** mL/min
├.Length	Tube length	**0**...30000 mm
└.Diameter	Tube diameter	0...**2**...20 mm
└.4	Settings of port 2	
├.MaxRate	Maximum feeding rate	0.01...**160** mL/min
├.Length	Tube length	**0**...30000 mm
└.Diameter	Tube diameter	0...**2**...20 mm
└.RSset	**Settings of the RS232 interface**	$G
├.Baud	Baud rate	19200; **9600**; 4800; 2400; 1200; 600; 300
├.DataBit	Data bits	7; **8**
├.StopBit	Stop bits	**1**; 2
├.Parity	Parity	even; odd; **none**
├.Handsh	Handshake	**HWS**; SWchar; SWline; none
└.CharSet	External printer definition	**IBM**; Epson; Seiko; Citizen; HP DeskJ

2.4 &Info - Instrument data

Object	*Meaning*	*Entry range/Selection*
&Info		
.Report	**Report output**	$G
.Select	Report selection	**config**; usermeth; param; all
.ActualInfo	**Actual data**	
.Lift	Actual data of lift stations 1 and 2	
.1	**Lift 1**	
.Exist	Availability of lift	yes; no
.MaxHeight	Maximum stroke path	0…235 mm
.ActHeight	Current lift position	0…235 mm
.Beaker	Presence of a beaker at tower sensor	yes, no
.ActPos	Rack position at lift 1	0…999
.Angle	Current rotation angle of the rack	0…359.90°
.Rackkoord	Coordinates of current rack position	
.Angle	Rotation angle	0…359.90°
.Radius	Radius of rack position	0…250 mm
.SwingHead	Swing head data	
.Exist	Availability of swing head 1	yes, no
.Angle	Current swing angle	0…270.0°
.Beaker	Presence of a beaker at swing head sensor	yes, no
.2	**Lift 2**	
.Exist	Availability of lift	yes; no
.MaxHeight	Maximum stroke path	0…235 mm
.ActHeight	Current lift position	0…235 mm
.Beaker	Presence of a beaker at tower sensor	yes, no
.ActPos	Rack position at lift 2	1…999
.Angle	Current rotation angle of the rack	0…359.90°
.Rackkoord	Coordinates of current rack position	
.Angle	Rotation angle	0…359.90°
.Radius	Radius of rack position	0…200 mm
.SwingHead	Swing head data	
.Exist	Availability of swing head 1	yes, no
.Angle	Current swing angle	0…270. 0°
.Beaker	Presence of a beaker at swing head sensor	yes, no
.Rack	**Current rack data**	
.Code	Rack code	000000…111111
.Name	Rack name	10 characters
.Stirrer	**Current stirrer data**	
.T1	Stirrer on tower 1	
.Rate	Stirring rate	0…15
.State	Stirrer status	on, off
.T2	Stirrer on tower 2	
.Rate	Stirring rate	0…15
.State	Stirrer status	on, off
.MSB1	MSB stirrer 1	
.Type	Type of stirrer	0, 801, 804, …
.Rate	Stirring rate	0…15
.State	Stirrer status	on, off
.MSB2	MSB stirrer 2	
.Type	Type of stirrer	0, 801, 804, …
.Rate	Stirring rate	0…15

│ └.State	Stirrer status	on, off
├.MSB3	MSB stirrer 3	
│ ├.Type	Type of stirrer	0, 801, 804, …
│ ├.Rate	Stirring rate	0…15
│ └.State	Stirrer status	on, off
├.Pump	**Current pump states**	
│ ├.1	Pump 1	
│ └.State	Pump status	on, off
│ ├.2	Pump 2	
│ └.State	Pump status	on, off
│ ├.3	Pump 3	
│ └.State	Pump status	on, off
│ ├.4	Pump 4	
│ └.State	Pump status	on, off
├.Peristaltic	**Peristaltic pump info**	
│ ├.Rate	Pump rate	-15…-1, 1…15
│ └.State	Pump status	on, off
├.Valve	**Valve info**	
│ ├.Exist	Installed or not	yes, no
│ └.Position	Valve position	fill, inject
├.Buret	**Buret data**	
│ ├.1	Dosing drive **DOS1**	
: ├.State	Drive status	ready, busy, none
├.Position	Current piston position	0…50.0 mL
├.Cock	Current cock position	1…4
├.Type	Type of dosing device	685, 700, 800, 805
: └.Volume	Nominal cylinder volume	1 mL, …, 50 mL
│ ├.2	Dosing drive **DOS2**	
: ├.State	Drive status	ready, busy, none
├.Position	Current piston position	0…50.0 mL
├.Cock	Current cock position	1…4
├.Type	Type of dosing device	685, 700, 800, 805
: └.Volume	Nominal cylinder volume	1 mL, …, 50 mL
│ └.3	Dosing drive **DOS3**	
├.State	Drive status	ready, busy, none
├.Position	Current piston position	0…50.0 mL
├.Cock	Current cock position	1…4
├.Type	Type of dosing device	685, 700, 800, 805
└.Volume	Nominal cylinder volume	1 mL, …, 50 mL
├.Inputs	**Remote interface data**	
│ └.Status	Status of input lines	0…255
├.Outputs	**Remote interface data**	
│ └.Status	Status of the output lines	0…255
├.Display	**Display content**	
│ ├.L1	Display line 1	24 ASCII characters
│ └.L2	Display line 2	24 ASCII characters
└.Counter	**Sequence counter**	
├.Sample	Current sample	0…1000
└.Maximum	Number of samples to be processed	0…1000

2.5 &Setup - Instrument setup

Object	*Meaning*	*Entry range/Selection*
&Setup		
.IdReport	Report identification	**on**; off
.Keycode	Sending of key codes	on; **off**

Code	Key	Code	Key
1	<HOLD / LEARN>	16	<7 / SAMPLE>
2	<STOP>	17	<4 / PUMP>
3	<START>	18	<1 / SCAN>
4	<CONFIG>	19	<0 / DEF>
5	<PARAM>	20	<END>
6	<USER METHOD>	21	<→>
7		22	<CLEAR / RESET>
8	<9 / LIFT>	23	<ENTER>
9	<6 / DOS>	24	<↑>
10	<3 / WAIT>	25	<↓>
11	<* / RACK>	26	<SELECT / TOWER>
12	<8 / MOVE>	27	<QUIT>
13	<5 / STIR>	28	<HOME>
14	<2 / CTRL>	29	<←>
15	<. / PRINT>	30	<INSERT>
		31	<DELETE>

.Tree	**Sending format of path info**	
.Short	Short format of path info	on; **off**
.Trace	Message output on changed values	on; **off**
.Lock	**Locking of key functions**	
.Keyboard	Lock all keys	on; **off**
.Config	Lock <CONFIG> key	on; **off**
.Parameter	Lock <PARAM> key	on; **off**
.UserMeth	User method functions	
.Recall	Lock method loading	on; **off**
.Store	Lock method storing	on; **off**
.Delete	Lock method deletion	on; **off**
.Display	Lock display function	on; **off**
.ChangerSetup	**Changer setup**	
.SwingH1	Settings of Swing head 1	
.Distance	Axial distance (Swing head — Rack)	100…**166.0**…300.00 mm
.Offset	Swing angle offset	-270.00…**8.00**…270.00°
.MaxAngle	Maximum swing angle	0…**117**…330.00°
.Radius	Swing head length	30.00…**112.00**…300.00 mm
.RotOffset	Rotation angle offset	-270.00…**0**…270.00°
.SwingDir	Swing direction / mounting of swing head	**+**, **–**
.SH1Adjustment	Swing Head adjustment data 1	(↓ these are typical values)
.SwingheadNo	Type of Swing head drive	786
.SerialNo	Serial number of Swing head drive	02143
.AnglePos	Adjustment angle of the light barrier (positive)	-8.59
.AngleNeg	Adjustment angle of the light barrier (negative)	-8.59
.RotOffset	Offset angle in rotational direction	0.00
.Distance	Axial distance (Swing head — Rack)	166.00

├.SwingH2	Settings of Swing head 2	
: ├.	see above	
├.SH2Adjustment	Swing Head adjustment data 2	
: ├.	see above	
├.TTAdjustment	Turntable adjustment data	(↓ these are typical values)
: ├.TurntableNo	Type of turntable	838
├.SerialNo	Serial number of turntable	01109
├.HallSensor	Offset of hall sensor (rack recognition)	-3.00
├.Tower1	Rotational offset of tower 1	0.00
├.SpaceT12	Angle between tower 1 and tower 2	0.00
├.SwingAxis1	Rotational offset of swing axis 1	0.00
├.SwingAxis2	Rotational offset of swing axis 2	0.00
├.DistanceT1	Axial distance of Swing head1 — Rack *	166.0
└.DistanceT2	Axial distance of Swing head1 — Rack *	166.0
	* used when no Swing head present	
├.Mode	**Waiting interval settings**	
├.StartWait	Waiting time after method start	on; **off**
├.AutoInfo	**Automatic messages on changes**	
├.Status	Switch AutoInfo on/off	**on**; off
├.P	Message when power on (R$.Mode.XXXX.Inac)	on; **off**
├.Ch	Messages of sample changer functions	on; **off**
: ├.G	Go: Method has been started	on; **off**
├.GC	Go command: Start command received	on; **off**
├.R	Ready: Status 'Ready' reached	on; **off**
├.S	Stop: Status 'Stop' reached	on; **off**
├.H	Hold: Status 'Hold' reached	on; **off**
├.C	Continued: Resuming after Hold	on; **off**
├.B	Begin: Begin of sample sequence	on; **off**
├.F	Final: End of sample sequence	on; **off**
├.RC	Rack changed: Rack has been exchanged	on; **off**
├.OM	Opening moves (Start sequence)	on; **off**
└.CM	Closing moves (Final sequence)	on; **off**
:		
└.E	Message on error occurrence (!*InstrName*".E;E*xx*")	on; **off**
├.PowerOn	RESET (Power on)	$G
├.Initialize	Memory initialization	$G
└.Select	Selection of the tree branch	all; param; config; user meth; setup;assembly
├.RamInit	Initialization of the working memory	$G
└.InstrNo	Device identification	$G
└.Value	Name of the device	8 ASCII characters

2.6 &UserMeth - User defined methods

Object	*Meaning*	*Entry range/Selection*
&UserMeth	**File operations**	
.FreeMem	Memory available	read only
.Recall	**Loading of methods**	$G
.Name	Method name	8 ASCII characters
.Store	**Saving of methods**	$G
.Name	Method name	8 ASCII characters
.Delete	**Deleting of methods**	$G
.Name	Method name	8 ASCII characters
.DelAll	**Deleting of all methods**	$G
.List	**List of stored methods**	
.1		
.Name	Method name	read only
.Mode	Mode	read only
.Bytes	Method size in bytes	read only
.Checksum	Checksum of method	read only
.x	up to x methods, depending on memory available	
.Name	..	..
.Checksum	..	..

Remark on file operations

First set the file names (node: `.Name`), then send the trigger $G for the corresponding function:.

Example: Loading a method

```
&U.R.N"Chloride"
&U.R;$G
```

2.7 &Assembly - Instrument components

Object	*Meaning*	*Entry range/Selection*
&Assembly		
├.Sample	**Sample control**	$G
│ ├.Func	Selection of function	**=**, +, –
│ └.Value	Value of function	**1**...999
├.Move	**Rack and Swing head movement**	$G, $S, $H, $C
│ ├.Target	Lift selection	**1**, 2
│ └.Position	Beaker or Swing head position	**sample**, ext.1…4, next, prev. spec1...16, +swing, -swing, +rotate, -rotate, -999…1...+999,
├.Rotat	**Turntable control**	$G, $S, $H, $C
│ ├.Tower	Tower selection	**1**, 2
│ └.Angle	Rotation angle	**0**...359.99°
├.Swing	**Swing head control**	$G, $S, $H, $C
│ ├.Tower	Address / tower of Swing head	**1**, 2
│ └.Angle	Swing angle	-45.00…**0**…270.00°
├.Lift	**Lift control**	$G, $S, $H, $C
│ ├.Station	Lift selection	**1**, 2, *
│ └.Way	Target lift position	**work**, shift, rest, special, rinse, 0 mm...max. lift path
├.Stir	**Stirrer control**	$G, $S
│ ├.Address	Stirrer selection	**T1**, T2, T*, MSB1,MSB2, MSB3, MSB*, *
│ └.Value	Time or status	**1**...9999 s, on, off
├.Pump	**Pump control**	$G, $S
│ ├.Address	Pump selection	**1.1**, 1.2, 1.*, 2.1, 2.2, 2.*
│ └.Value	Time or status	1...999 s, **on**, off
├.Peristaltic	**Peristaltic pump control**	$G
│ ├.State	Status of the pump	**off**, on
│ └.Rate	Pump rate	-15…-1, 1…**3**…15
├.Valve	**Valve control**	$G
│ └.Position	Switching the valve	**fill**, inject
├.Dos	**Dosing functions**	$G, $S, $H, $C
│ ├.Address	Drive and port selection	**1.***, … 3.4, *.*
│ └.Value	Dispensing volume or dosing function	±0.001...**1**...999.999 mL, fill, release, prepar., empty, eject, endVol, compen.,port
├.Scan	**Scanning of interfaces**	$G, $S
│ ├.Address	Interface selection	**Rm**, RS
│ └.Pattern	Signal pattern or data string	Remote interface: 8 x 1,0 or * (binary pattern) **Ready1**, Ready2, Ready*, Cond ok, End1, End2, Endmeter, Continue

		RS 232 interface: 14 ASCII characters, **!*.R"**
.Ctrl	**Interface control**	$G
.Address	Interface selection	**Rm**, RS
.Pattern	Signal pattern or data string	Remote interface: 14 x 1,0 or ***** (binary) START device1, START device2, START device*, SAMPLE ready, START dos1, START dos2, START dos*, METER mode pH, METER mode T, METER mode U, METER mode I, METER mode C, METER cal pH, METER cal C, METER enter, **INIT** RS 232 interface: 14 ASCII characters, **&M;$G**
.Def	**Re-definitions of different settings**	$G
.Object	Item selection	**STIRRATE**, DOSRATE, FILLRATE, COCKMOVE, LIFTRATE, SHIFTRATE, SWINGRATE
.Adress	Component address	*depending upon item*
.Value	Value / parameter	*depending upon item*
.Object	**Stirring rate**	STIRRATE
.Adress	Stirrer address	**T1**, T2, T*, MSB1,MSB2, MSB3, MSB*, *
.Value	Rate	1...**3**...15
.Object	**Dosing rate**	DOSRATE
.Adress	Dosing drive address	**1**...3
.Value	Rate	0.01...160 ml/min, **max.**
.Object	**Filling rate**	FILLRATE
.Adress	Dosing drive address	**1**...3
.Value	Rate	0.01...160 ml/min, **max.**
.Object	**Rotational direction of valve disk**	COCKMOVE
.Adress	Dosing drive address	**1**...3
.Value	Direction	**auto**, not over, desc., asc.
.Object	**Lift rate**	LIFTRATE

├.Adress	Lift address	**1**, 2
└.Value	Rate	5...**25** mm/s
├.Object	**Shifting rate and direction of the rack**	SHIFTRATE
*		
├.Adress	Shifting direction	**auto**, +, –
└.Value	Shifting rate	3...**20** °/s
:		
├.Wait	**Waiting time**	$G, $S, $H, $C
│ ├.Func	Function	**PAUSE**, RUNTIME
│ └.Time	Time	0...**1**...9999 s
├.Beaker	**Beaker test**	$G
│ └.Address	Sensor selection	**Tower1**, Tower2, Swing1, Swing2
└.Rack	**Rack reset**	$G

2.8 &Diagnose - Instrument diagnosis

&Diagnose		
├─.Init	**RAM initialization**	$G
│ └─.Select	Selection of memory range to initialize	**all**, param, config, user meth, setup, assembly
├─.RamTest	RAM integrity test	$G
├─.TimeInit	Initialize time meter	$G
├─.DefaultSettings	Set all nodes to default settings	$G
├─.Anglesadjust	Adjustment of Swing angles	$G
├─.LcdTest	Display test	$G, $S
├─.ContrastTest	Display contrast test	$G, $S
├─.KeyTest	Keyboard test	$G, $S
├─.IoTest	Remote socket test	$G
├─.RsTest	RS232 interface test	$G
├─.MSBTest	MSB bus test	$G, $S
├─.BeeperTest	Beeper test	$G, $S
├─.RackcodeTest	Rack code test	$G
├─.FunctionTest	Detailed instrument function test	$G
├─.SimulateKey	Keycode simulation	1..31, see page 19
├─.Flash	Write Flash-ROM	$G
├─.PowerOn	'Power on' simulation	$G
└─.InstrNo	Instrument number	not accessible via RS232 interface

3 Properties of the RS 232 Interface

3.1 Data Transfer Protocol

Metrohm instruments are configured as DTE (Data Terminal Equipment).

The RS 232 interface has the following technical specifications:

- Data interface according to the RS 232C standard, adjustable transfer parameters, see pages 14ff.
- Max. line length: 512 characters
- Control characters: C_R (ASCII DEC 13)
  L_F (ASCII DEC 10)
  XON (ASCII DEC 17)
  XOFF (ASCII DEC 19)
- Cable length: max. approx. 15 m

Start	7 or 8 Data Bit	Parity Bit	1 or 2 Stop Bit

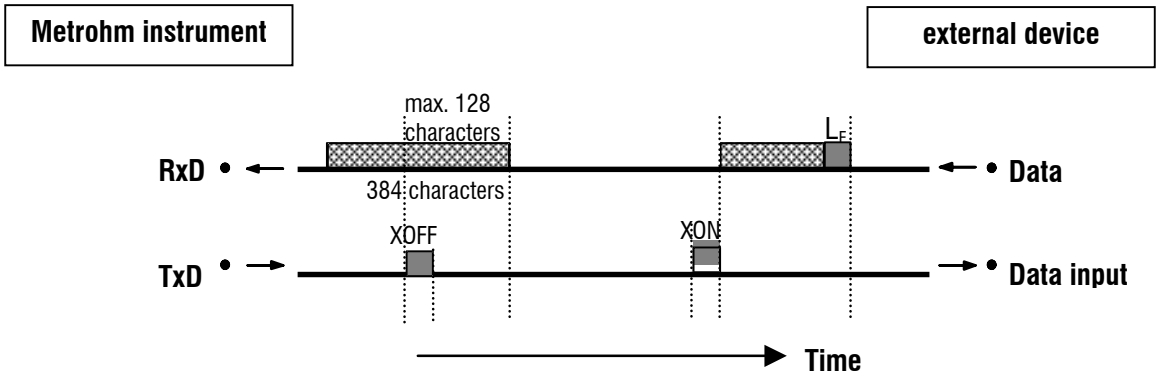
Only a shielded data cable (for example, 6.2125.110) may be used to couple Metrohm instruments with foreign devices. The cable shield must be properly grounded on both instruments (pay attention to current loops).

3.2 Handshake

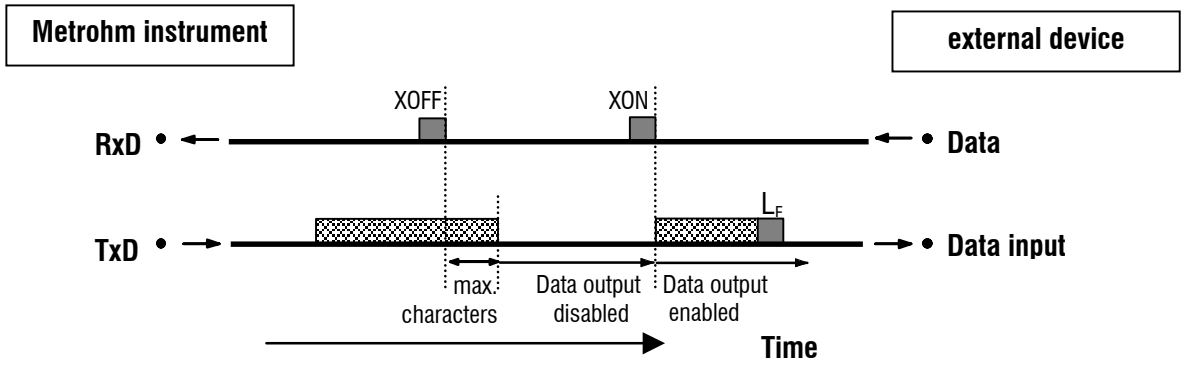
Software-Handshake, SWchar

Handshake inputs on the instrument (CTS) are not checked.
Handshake outputs (DTR, RTS) are set by the instrument.
The instrument sends XOFF when its input buffer contains 384 characters. After this it can receive 128 extra characters (including L_F). When the buffer is cleared to 128 characters, XON is sent.

Metrohm instruments as Receiver :



Metrohm instrument as Sender :

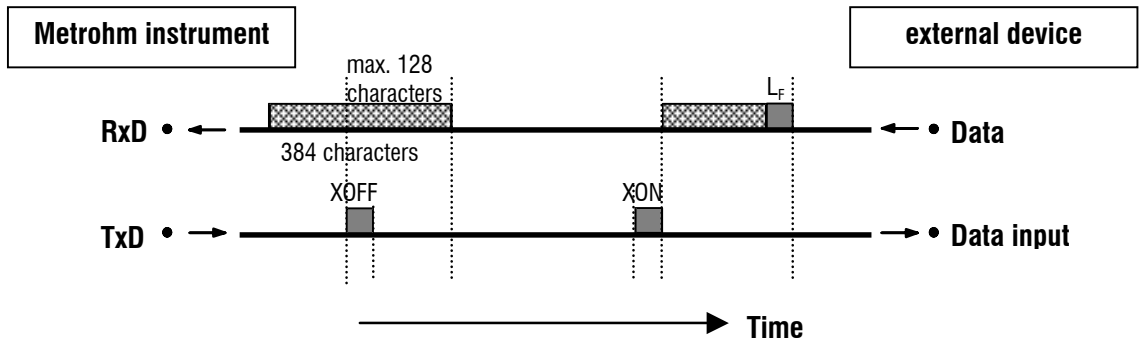


max. characters: 2 characters at 300...9600 baud
16 characters at ≥ 19200 baud

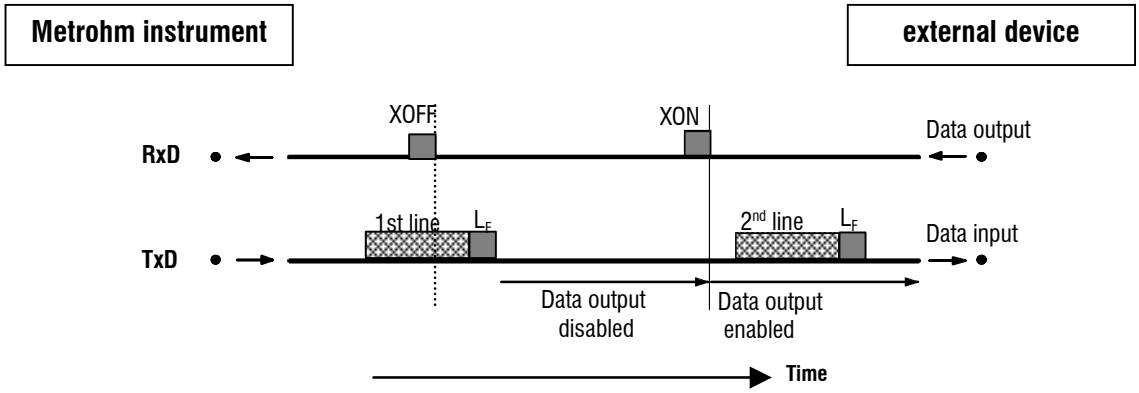
Software-Handshake, SWline

Handshake input ports on the instrument (CTS) are not checked.
Handshake output ports (DTR, RTS) are set by the instrument.
The instrument has an input buffer which can accept up to 512 characters.

Metrohm instrument as Receiver :



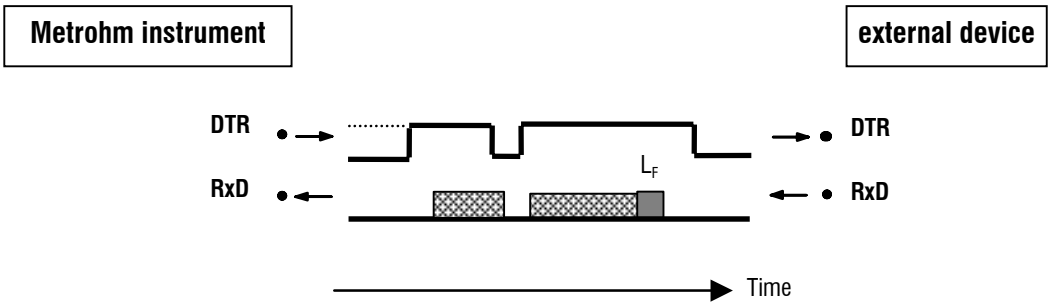
Metrohm instrument as Sender:



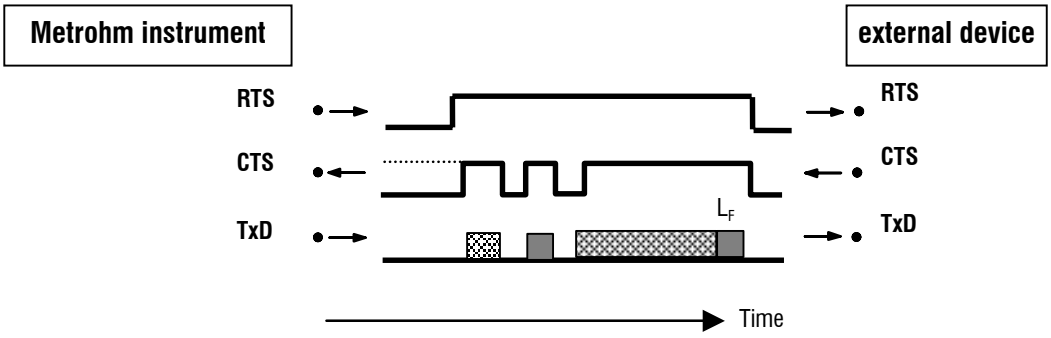
The instrument's transmission can be stopped by external instruments with XOFF. After XOFF is received the instrument completes sending the line already started. If data output is disabled for more than 10 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

Metrohm instrument as Receiver :



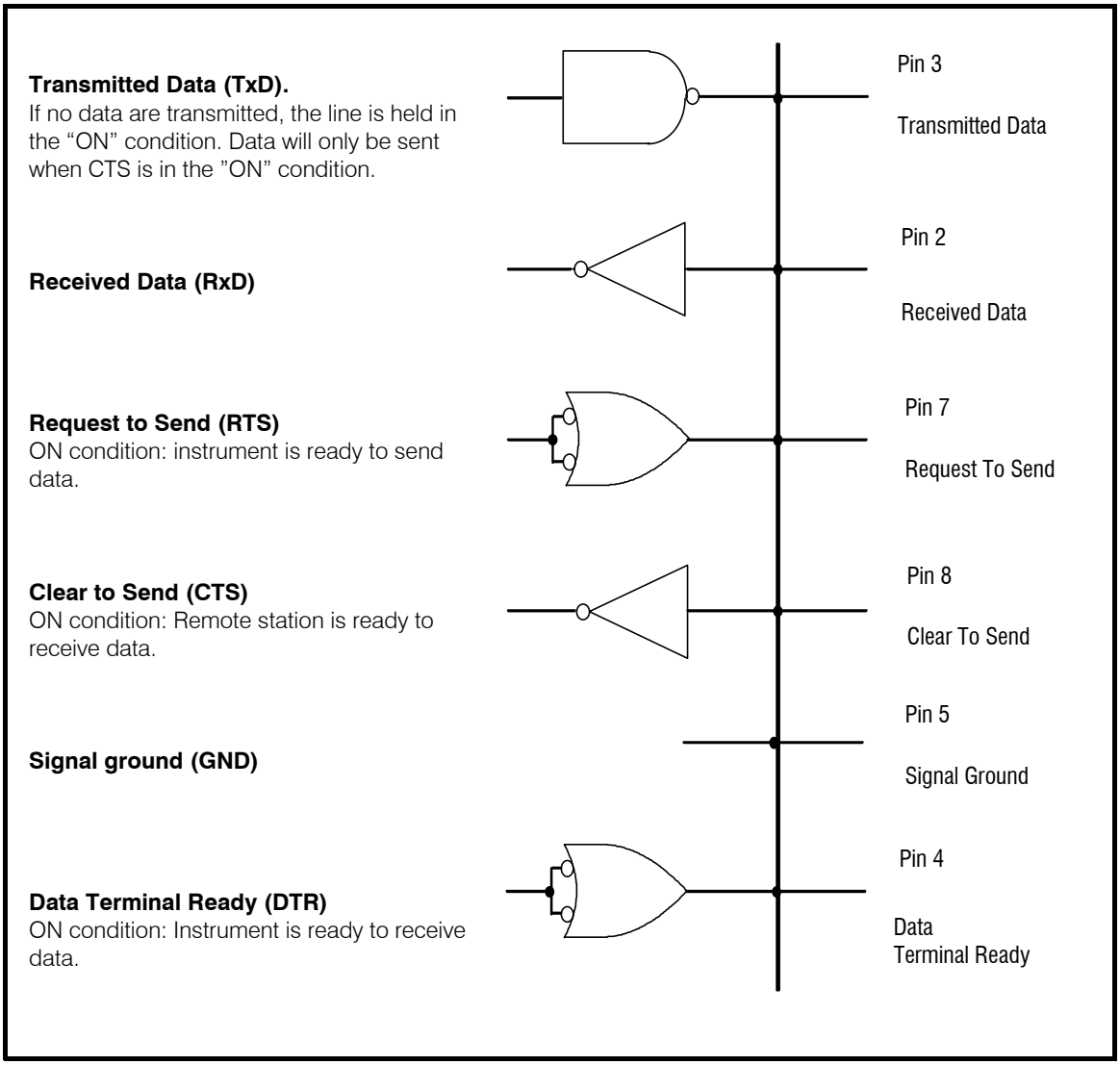
Metrohm instrument as Sender:



The data flow can be interrupted by deactivating the CTS line.

3.3 Pin Assignment

RS232C Interface



Protective earthing

Direct connection from cable plug to the protective ground of the instrument.

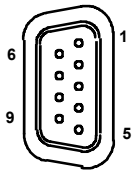
Polarity allocation of the signals

- Data lines (TxD, RxD)
  voltage negative (<-3 V): signal state ”ON”
  voltage positive (>+3 V): signal state ”ZERO”
- control or message lines (CTS, RTS, DTR)
- voltage negative (<-3 V): OFF state
- voltage positive (>+3 V): ON state

In the transitional range from +3 V to -3 V the signal state is undefined.

Driver 14C88 according to EIA RS 232C specification
Receiver 14C89 " "

Contact arrangement at plug (female) for RS 232C socket (male)



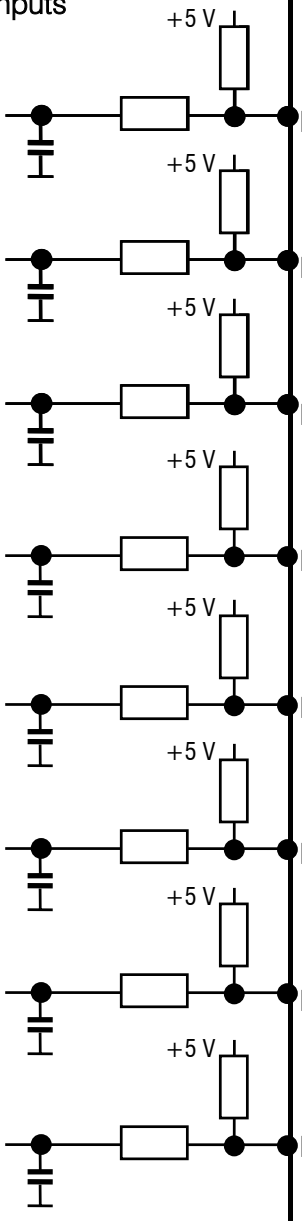
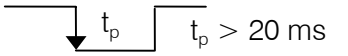
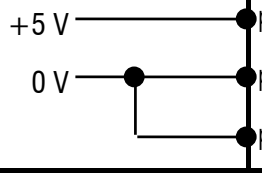
No liability whatsoever will be accepted for damage or injury caused by improper interconnection of instruments.

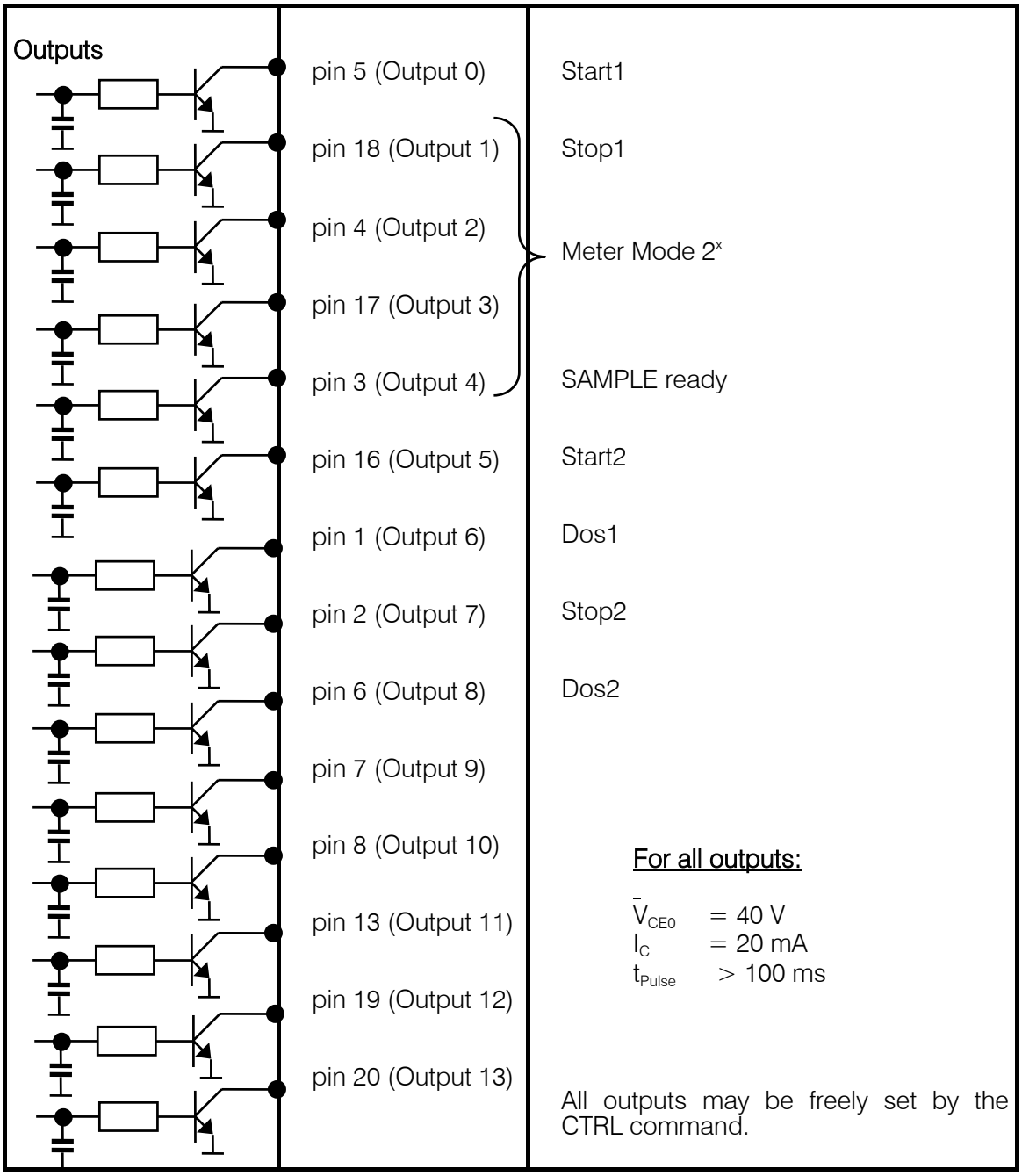
3.4 What can you do if data transfer fails?

Problem	Questions for remedial action
No characters can be received on a connected printer.	- Are the instruments switched on and cables plugged in correctly? - Is the printer set to ”on-line”? - Are baud rate, data bit and parity the same on both instruments? - Is the handshake set properly? If everything seems to be OK, try to print a report with the key sequence <PRINT><ENTER>.
No data transmission and the display of the instrument shows an error message.	- error 42: Transmission error. Is the printer set to "on-line"? Is the connection cable properly wired? - error 43: Data output of the instrument disabled for longer than 10 s by XOFF. - error 36-39: Receive error. Are the RS settings the same on both devices?
The received characters are garbled.	- Are the RS settings the same on both devices? - Has the correct printer been selected? - Data transfer has been interrupted on the hardware side during the printout of a curve. Re-establish connections and switch printer off/on.
Wrong line spacing.	The printer does not emulate completely the preset mode. Usually these problems arise with the IBM mode. Set the printer to a different mode (e.g. Epson).
Printout of a curve is not ok. Other reports are printed ok.	Handshake is necessary for the printout of curves. - Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the instrument.) - Set "HWs" for the handshake of the instrument. Configure the printer such that its DTR is set (possibly with DIP switches).

4 The Metrohm Remote Interface

4.1 Pin assignation of the Remote interface

	external	Function
Inputs 	pin 21 (Input 0) pin 9 (Input 1) pin 22 (Input 2) pin 10 (Input 3) pin 23 (Input 4) pin 11 (Input 5) pin 24 (Input 6) pin 12 (Input 7)	All input lines may be scanned by the SCAN command. Ready1 ~50 kΩ Pull up  Cond ok End1 Stirrer 780, Continue Ready2 external STOP *, End2 external START * ** if external START on*
Voltage 	pin 15 pin 14 pin 25	I ≤ 200 mA 0 V: active 5 V: inactive

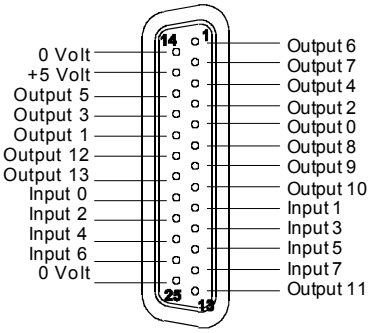


Ordering number for standard Remote cable:
6.2141.020, see Metrohm Accessories Catalog also.

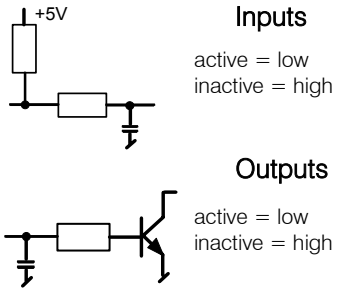
No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

4.1.1 The Remote socket

The pin assignation of a 25-pin remote plug can be seen from the information given below.



Remote plug
(with 25 pins)



Electrical switching of the inputs and outputs of the remote socket

4.1.2 Standard allocation of remote lines in Metrohm measuring and titration instruments:

Remote lines	Pin	Function
Input 0	21	Start
Input 1	9	Stop
Input 2	22	Enter
Input 3	10	Clear
Input 4	23	Sample Ready
Input 5	11	not used
Input 6	24	external STOP*)
Input 7	12	external START*)
Output 0	5	Ready
Output 1	18	Conditioning ok
Output 2	4	Determination busy
Output 3	17	EOD (End of Determination)
Output 4	3	L1
Output 5	16	Error
Output 6	1	Activate L3
Output 7	2	Pulse for recorder

*) Sample Processors only

Output lines 8…13 are mostly not used as standard.

Remark: Standard pin assignments are only activated in an instrument's single mode (not in sequence functions).

4.1.3 The standard Remote lines

Assignation of the remote socket according to pins:

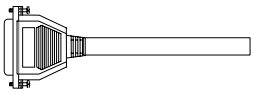
Pin	I/O line	Function
1	Output 6	L3 activate
2	Output 7	Pulse for recorder
3	Output 4	L1
4	Output 2	Determination busy
5	Output 0	Ready
6	Output 8	not used
7	Output 9	not used
8	Output 10	not used
9	Input 1	Stop
10	Input 3	Clear
11	Input 5	not used
12	Input 7	external START*)
13	Output 11	not used
14	0 Volt	
15	+5 Volt	
16	Output 5	Error
17	Output 3	EOD (End of Determination)
18	Output 1	Conditioning ok
19	Output 12	not used
20	Output 13	not used
21	Input 0	Start
22	Input 2	Enter
23	Input 4	Sample Ready
24	Input 6	external STOP*)
25	0 Volt	

*) Sample Processors only

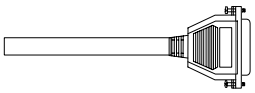
The pin assignation or the allocation of functions of the remote lines may differ slightly from one Metrohm instrument to another. Consult the '**Instructions for use**' of your instrument.

4.1.4 Wiring of the Metrohm Standard Remote cable

Order no. 6.2141.020 (25-pin)



Output 0 (Pin 5)	(Pin 21) Input 0
Output 1 (Pin 18)	(Pin 9) Input 1
Output 2 (Pin 4)	(Pin 22) Input 2
Output 3 (Pin 17)	(Pin 10) Input 3
Output 4 (Pin 3)	(Pin 23) Input 4
Output 5 (Pin 16)	(Pin 11) Input 5
Output 6 (Pin 1)	(Pin 24) Input 6
Output 7 (Pin 2)	(Pin 12) Input 7
Output 8 (Pin 6)	(Pin 6) Output 8
Output 9 (Pin 7)	(Pin 7) Output 9
Output 10 (Pin 8)	(Pin 8) Output 10
Output 11 (Pin 13)	(Pin 13) Output 11
Output 12 (Pin 19)	(Pin 19) Output 12
Output 13 (Pin 20)	(Pin 20) Output 13
Input 0 (Pin 21)	(Pin 5) Output 0
Input 1 (Pin 9)	(Pin 18) Output 1
Input 2 (Pin 22)	(Pin 4) Output 2
Input 3 (Pin 10)	(Pin 17) Output 3
Input 4 (Pin 23)	(Pin 3) Output 4
Input 5 (Pin 11)	(Pin 16) Output 5
Input 6 (Pin 24)	(Pin 1) Output 6
Input 7 (Pin 12)	(Pin 2) Output 7
0 V (Pin 14)	0 V (Pin 14)
0 V (Pin 25)	0 V (Pin 25)



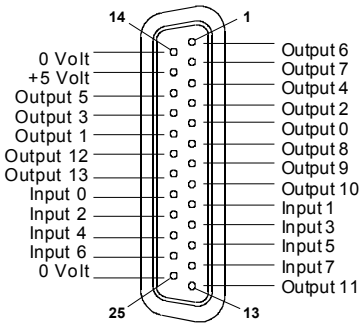
5 Technical specifications

5.1 Keypad

LC-display	2 Lines of 24 characters each Height 5 mm each
LED-displays	3 LEDs
Plastic foil keypad	key set of 30 keys

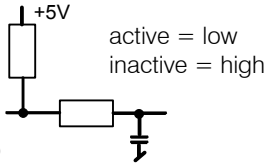
5.2 Interfaces

RS 232 plug	connector for computer or printer
Remote socket	programmable parallel interface for controlling external instruments, 14 signal lines (8x input, 14x output), TTL signal level



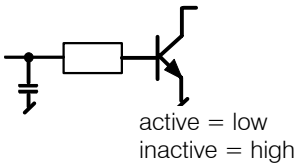
Input: t_p

t_p >20 ms
50 kΩ appr. pull up



Output: t_p

t_p >200 ms
V_{CEO} = 40 V
I_C = 20 mA
Open collector



+5 V: max. load = 20 mA

5.3 MSB Connections

3 MSB connectors	9 pin Mini-DIN sockets - for 800/700 Dosino or 805 / 685 Dosimat - for 801 Stirrer or 804 Ti-Stand

5.4 2 Channel peristaltic pump

Speed	± 6.7/min ... ± 100/min adjustable in ±15 steps	
Delivery rate (typical)	*Tubing*	*Delivery*
(with water, no back-	6.1826.010:	1.4 ml/min
pressure, dependent	6.1826.020:	3.8 ml/min
on contact pressure	6.1826.030:	0.4 ml/min
and tubing type, at	6.1826.040:	0.8 ml/min

20/min apart from 6.1826.150 in the case of 67/min)	6.1826.070: 6.1826.130: 6.1826.150:	2.6 ml/min 1.4 ml/min 23.8 ml/min

Pressure	max. 4 bar (0.4MPa)
Pumpable fluids	Clear fluids, no solids
Pump tubing material	PVC (Tygon® ST) PVC (Tygon® LFL) PP

5.5 Pump connectors

Outputs	M8 socket: U = 16 ± 1 V I ≤ 0.8 A

for 823 Membrane Pump Unit or 772 Pump Unit

5.6 Injection valve

Positions	Fill … Inject

5.7 Swing Head connector

Socket	9 pin Mini-DIN socket - for 786 Swing Head

5.8 Lift

Max. lift path	235 mm
Max. load	30 N appr.
Stroke speed	adjustable, 5...25 mm/s

5.9 Turntable

Turning speed	adjustable, 3...20 angular degrees/s

5.10 Stirrer connectors

Stirring speed	adjustable to 15 levels 741 Magnetic stirrer 180/min...2600/min 802 / 722 Rod stirrer 180/min...3000/min

5.11 Mains connection

Voltage	100… 240 V (±10%)
Frequency	50...60 Hz
Power input	115 W
Fuse	2.0 ATH

5.12 Safety specifications

Construction and testing	according to EN/IEC 61010-1, EN/IEC 61010-2-081, UL 3101-1 protecion class I
Safety notice	This instruction manual contains information and warnings which the user should follow to guarantee the safe operation of the instrument.

5.13 Electromagnetic Compatibility (EMC)

Emitted Interference	Specifications met: - EN/IEC 61326 - EN 55022 / CISPR 22 - EN/IEC 61000-3-2
Interference immunity	Specifications met: - EN/IEC 61326 - EN/IEC 61000-4-2 - EN/IEC 61000-4-3 - EN/IEC 61000-4-4 - EN/IEC 61000-4-5 - EN/IEC 61000-4-6 - EN/IEC 61000-4-8 - EN/IEC 61000-4-11 - EN/IEC 61000-4-14 - NAMUR

5.14 Temperatures

Nominal functional range	+5…+45 °C (max. 80 % humidity)
Storage	-20 ...+60 °C humidity < +40 °C < 95% humidity < +50 °C < 85% humidity < +60 °C < 50%
Transport	-20 ...+60 °C humidity < +40 °C < 95% humidity < +50 °C < 85% humidity < +60 °C < 50%

5.15 Dimensions and material

Height	0.73 m
Width	0.28 m
Depth	0.50 m
Weight (not including accessories)	15.50 kg (1.838.0010) 15.90 kg (1.838.0020)

Materials	
- *Sample changer housing*	Metal housing, surface-treated
- *Keypad housing*	Crastin (PBTB), aluminium-sputtered on inside
- *Keypad film*	Polyester, chemical-resistant