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Technical Documentation



MTCS-ME1

modEVA-Kit with JENCOLOR Sensors

µC Version 3.3x, PC SW Version 4.001

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1 Introduction

Industrial color detection, measurement and monitoring are becoming easier. Notably, where colors are to be detected, measured or compared in a highly dynamic working environment and with little technical effort, MAZeT's JENCOLOR sensor IC design provides the optimal solution, both technically and economically.

Sensors of this type use the RGB Tri-Stimulus method, imitating the human eye's natural color perception (MCS series), or, alternatively, a method according to DIN 5033, Part 2 – Color Measurement; Standard Colorimetric Systems – CIE 1931 Tri-Stimulus Value Function (MTCS series)¹. JENCOLOR ICs are available in different styles and package versions and can be fitted with a broad range of accessory items (e.g. demonstrator of initial system testing).

In addition to its IC solutions, MAZeT offers a modular MTCS1-ME1 hardware solution based on the MTCS series, which will be described hereafter.

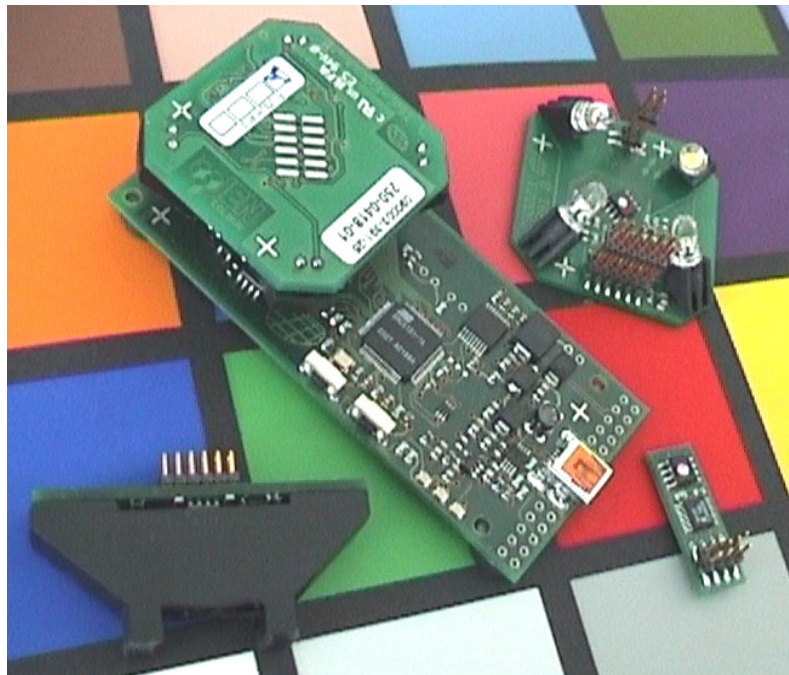


Figure 1, MTCS-ME1 main board with sensor module mounted:

The modular MTCS-ME1 hardware solution consists of a main board that is configured with a plug module as required for a particular application.

The main board integrates all signal processing resources, including interfacing and measuring control. Various component versions can be provided for customized adaptation to a given specific PCB functionality or connector shape to fit the plug modules (e.g. viewing direction of sensor).

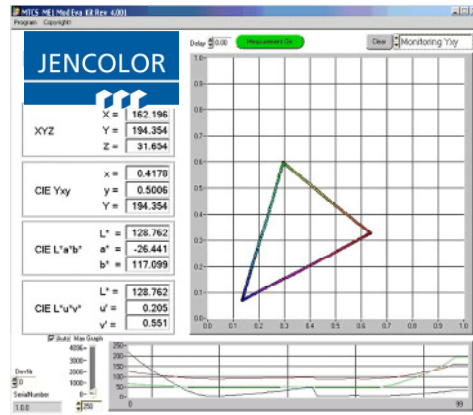
¹ For data and application sheets, you should contact one of our sales offices.

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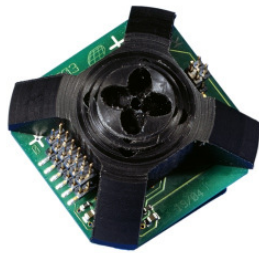
Each plug module contains, besides the JENCOLOR ICs, an alternative signal amplifier chain (dynamic or time integral) and different light sources (e.g. 4/2/0 white LED), using mechanical aperture blades to comply with 45/0 measuring geometry requirements under DIN 5033, Part 7.

The standard MTCS-ME1 kit with USB interface includes PC software under MS-Windows™ to handle functions like sensor calibration and anything in connection with measured value representation and output, e.g. in the CIE Lab color space.

Further available items are: Firmware Driver for Interfaces and an API Application Programming Interface (DLL) with test software.



TOP plug module
(four LEDs with dynamic signal gain)
with optics mounted onto/removed from main board for reflective color measurement



DARK plug module
mounted onto main board, e.g. for light measurement (colorimeter)

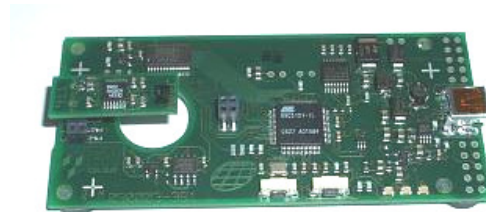
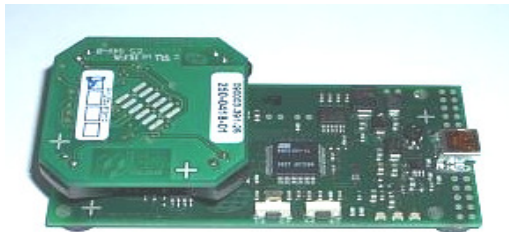
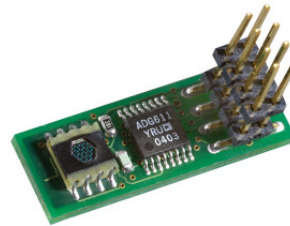


Figure 2, MTCS-ME1 sample configurations

The MTCS-ME1 concept comprises a whole series of prefabricated components. These can be combined into a package that will fit the given a specific application scenario. All prefabricated modules have been developed and manufactured to match industrial requirements, i.e. they are immediately available in large batches and qualified for industrial use. The MTCS-ME1 concept is being continuously extended, especially by new plug modules and accessory items.

Dedicated drivers and software libraries can be provided for necessary software (and firmware) matching. They are also subject to continuously ongoing development and extension. Please do not hesitate to contact us for latest information about available components and scopes of delivery.

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2 Starting Up

2.1 Scope of Delivery

MTCS-ME1 delivery includes²:

- 1 MTCS-ME1 main board (modEVA or modEVA(front) μ C version 2.2x)
- 1 ME sensor board (TOP / FRONT / DARK TIA or CCC)
- USB cable
- Test software (optional USB driver of SYS and DLL type)³
- Documentation
- Standard RoHS-conform

2.2 System Requirements

For start-up procedures, the following system resources are required:

- PC Pentium 150 MHz or higher
- 8 MB RAM, 5 MB free hard drive memory
- One free USB(2.0) port
- MS Windows™ XP

2.3 Components Hookup

*Viewing
direction
of sensor IC*

- Version 1: 180°

- Version 2: 90°
against mainboard

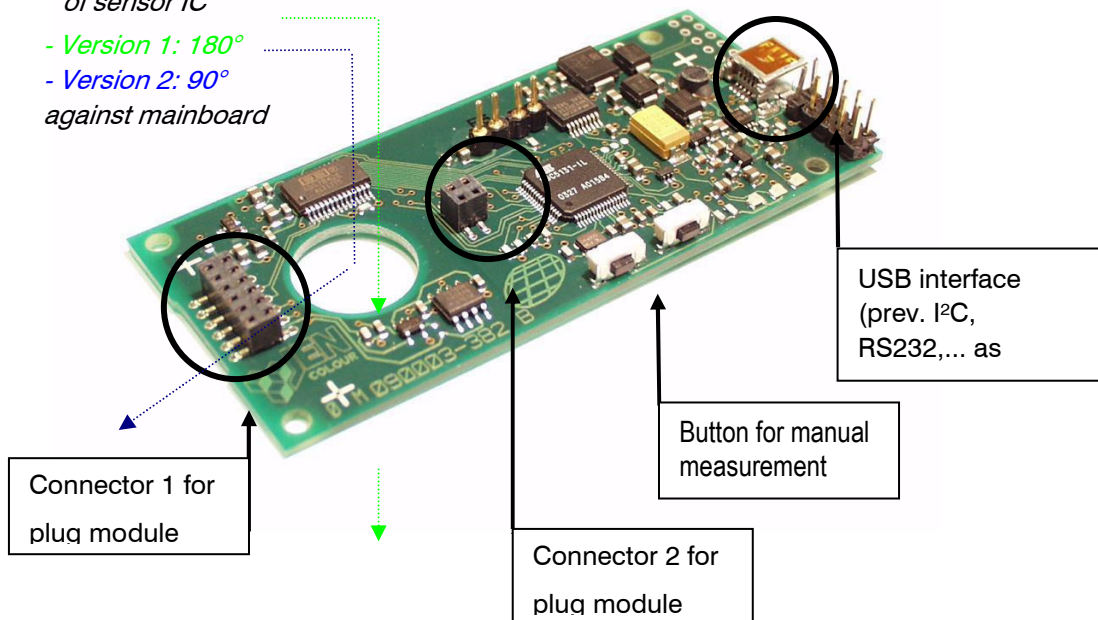


Figure 3, MTCS-ME1 main board

² Please note, all components must be ordered as single positions.

³ See document db05171e Software Description MTCS-ME1 Library Description (MTCSApi.dll)

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2.4 Software/Driver Installation

The “setup.exe“ file will install the user interface on your PC.

After a successful installation, the setup procedure should copied the files “modeva.inf“ and “usbio.sys“ to the directories “windows\inf“ and “windows\system32\drivers“⁴. Use the USB cable (supplied) to connect the MTCS-ME1 to a free USB (2.0) port of your PC. The device manager will output a message “Found new device“.

Select “Automatic software installation“, then press “Continue“.

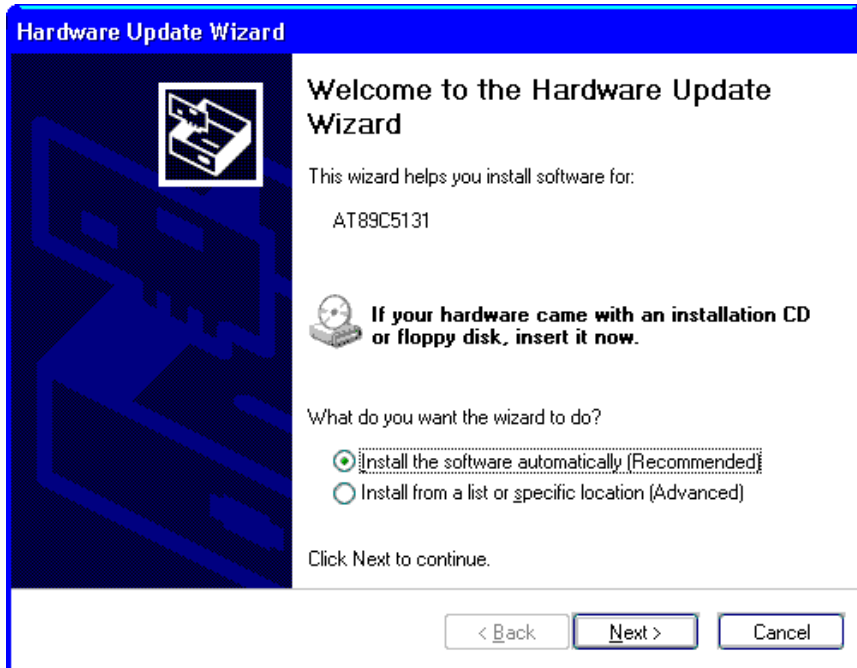


Figure 4, Microsoft assistant for USB driver installation

In case the software does not install automatically, you should check the directory to which the setup procedure had copied the .ini and .sys files. Take this directory for the further driver installation.

After a successfully installation please complete the modEVA hardware, connect it via USB to the PC and start the MTCS software.

3 Hardware

The hardware of a modular Eva kit can be configured to meet the particular application requirements. Please plug the sensor board onto the main board

The modular design concept provides for a separation into analogue sensor parts on the one and digital processing and interface electronic components on the other hand. It allows a number of sensors to be lined up in a cascable chain with a minimum pitch of 10mm, i.e. the complete MTCS-MEK system or a customized signal evaluation branch can be cascaded.

⁴ Please check it whether there are any problems with the software after setup.

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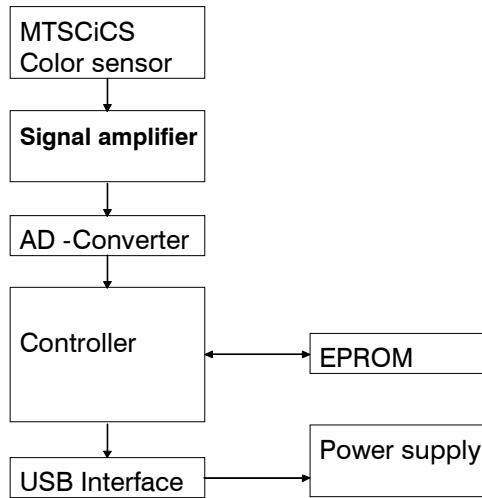


Figure 5, Block diagram of MTCS-ME1

Basically, four sensor modules are available at the moment⁵. They will be discussed with regard to potential applications in the following sections:

- MTCS-ME1 TOP
- MTCS-ME1 FRONT
- MTCS-ME1 DARK CCC
- MTCS-ME1 DARK TIA

3.1 MTCS-ME1 Main board

The MTCS-ME1 main board (modEVA or modEVA(front) with alternative electrical key for FRONT) is the basic signal pre-processing and post processing tool. It performs necessary digitization processes, contains the μ C and the firmware, handles digital signal pre-processing and provides various interfaces.

The following function modules are integrated on this board:

- Digitization with 12 bit resolution
- μ C-controlled signal detection
- USB interface (default) or RS232 and I²C⁶
- Free memory space for compensation and correction data
- pushbutton (Button 1 for manual triggering of measurement – see Figure 3)
- Three event indication LEDs (green=ready for operation, yellow= measurement running; red= data ready for transmission)
- Interrupt and IO terminal pin(s) for integration into control sequences⁷
- Voltage supply via USB
(separate operating voltage can be supplied for RS232 and I²C)
- Programmable voltage source to control target illumination sources.

⁵ Are continuously upgraded. Contact us for latest information: sales@mazet.de Phone +49 3641 2809-0.

⁶ Assembly hardware available on demand; software adaptation on request

⁷ See document db05178e Additional Technical Information MTCS-ME1 (Interfaces)

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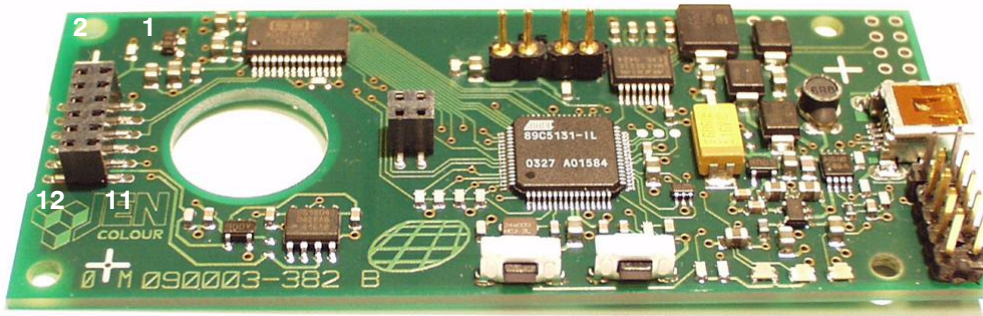


Figure 6, MTCS-ME1 main board

The standard microcontroller firmware is designed to support communication via a USB interface and handle all customized measuring algorithms:

- Simple ADC access operations
- Averaging of multiple ADC access operations
- Measured value logging by stray light compensation
- Smart control for signal integration (MTCS-ME1 DARK with current-to-charge conversion)
- Brightness control of illumination LEDs
- Management of customized settings and calibration data

The main board is available in two different component versions:

- modEVA with vertical pin jack for MTCS-ME1 TOP and MTCS-ME1 DARK
- modEVA(front) with angled pin jack for flat design shape with MTCS-ME1 FRONT.

The signals of both sensor board versions share a double line and 12-pole pin bar jack interface (with 2mm pin pitch). Figure 7 and Table 3-1 show the various signal assignments.

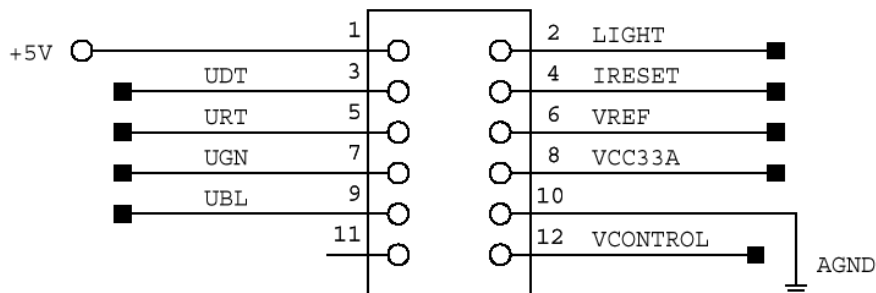


Figure 7, Signal assignments of sensor interface

Table 3-1: Signal assignments of sensor interface

PIN	I/O	NAME	DESCRIPTION
1	E	+5V	Analogue operating voltage for target illumination
2	E	LIGHT	Turns target illumination on
3	A	UDT	Signal level of isolating diode (not used)
4	E	IRESET	Resets/discharges current-to-charge converter
5	A	URT	Red signal level

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PIN	I/O	NAME	DESCRIPTION
6	E	VREF	Reference voltage
7	A	UGN	Green signal level
8	E	VCC33A	Analogue operating voltage for signal gain
9	A	UBL	Blue signal level
10	E	AGND	Analogue frame ground
11		n.c.	
12	E	VCONTROL	Control voltage for target illuminator

For operation with a MTCS-ME1 DARK sensor board (8-pole connector), pins 1, 2, 11 and 12 remain unassigned.

3.2 MTCS-ME1 TOP

The configuration set of a MTCS-ME1 main board and a MTCS-ME1 TOP allows color measurement of flat reflective targets. For this purpose, the main board (preassembled with the MTCS-ME1 TOP) must be placed onto the target to be measured.

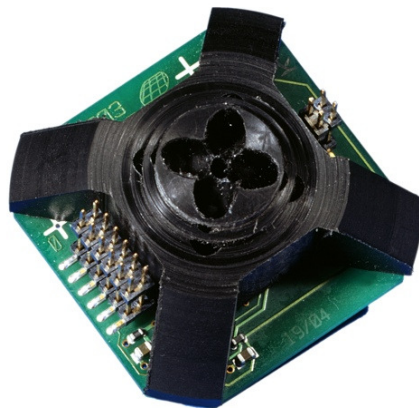


Figure 8, MTCS-ME1 TOP

The MTCS-ME1 TOP is vertically mounted onto the MTCS-ME1 main board (via the 12-pole and the 4-pole connector) in such a position that the target is illuminated and reflected light measured through the circular opening (15 mm) in the MTCS-ME1 main board.

The MTCS-ME1 TOP sensor module contains a MTCSiCS color sensor⁸ along with a four-position white illumination LED pad. Its plastic top ensures compliance with 45/0 measuring geometry requirements under DIN 5033, Part 7.

3.3 MTCS-ME1 FRONT

The configuration set of a MTCS-ME1 main board and a MTCS-ME1 FRONT allows color measurement of reflective targets if the main board (preassembled with the MTCS-ME1 FRONT) is held in front of the target to be measured.

⁸ Alternative MTCS/MCS series sensors are available on request

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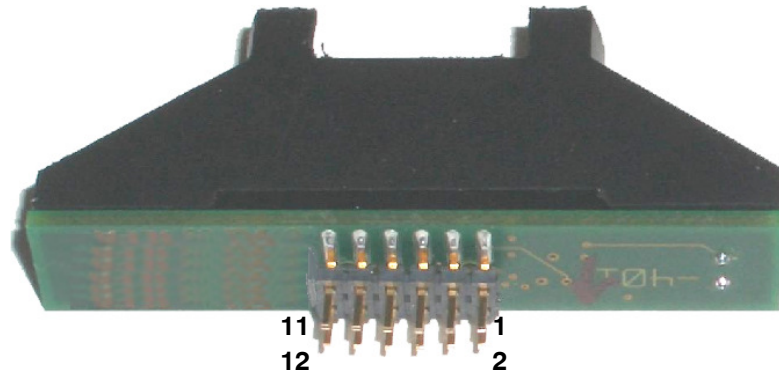


Figure 9, MTCS-ME1 FRONT

The MTCS-ME1 FRONT is mounted onto the MTCS-ME1 main board in horizontal position via an angled 12-pole connector.

The MTCS-ME1 FRONT sensor module contains a MTCSiCS color sensor along with a two-position white illuminator LED pad. Its plastic top ensures compliance with 45/0 measuring geometry requirements under DIN 5033, Part 7, plus a defined target distance.

3.4 MTCS-ME1 DARK

The configuration set of a MTCS-ME1 main board and a MTCS-ME1 DARK allows color measurement of luminous targets, e.g. LEDs or displays. It can also be operated in connection with alternative light sources, respectively (e.g. halogen or neon, not integrated in MTCS-ME1).

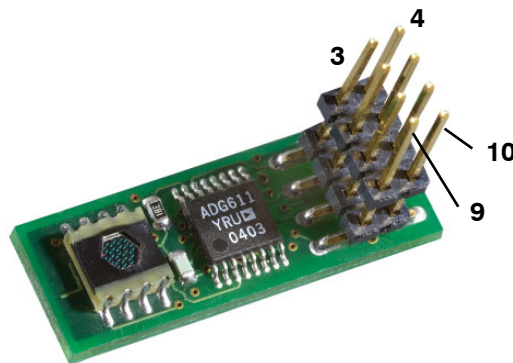


Figure 10, MTCS-ME1 DARK

Apart from the actual sensor IC, the MTCS-ME1 DARK sensor module solely contains sensor signal amplification circuitry.

This amplifier is available in two different board configurations:

- With current-to-charge converter for integration of photo currents from light sources varying over time (e.g. CRT monitors) and
- With transimpedance amplifier for measurement of light sources which are stable over time, as well as of reflective surfaces with their own illumination.

The MTCS-ME1-DARK is mounted onto the MTCS-ME1 main board in centre-aligned horizontal position using the 12-pole connector, with pins 1, 2, 11 and 12 unused.

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4 Software

4.1 Software Start

Based on an Ini-file some functions and parameters are to be defined in the mtcs - software. Please do not change the details in the Ini-file without support by MAZeT or your distribution partner⁹. The Ini-file includes the following sections and parameters:

Ini-File: conf.ini

```
[section1]
// if more than one device is plugged in
// wenn mehr als 1 device angeschlossen
DeviceAnzahl=1
// automatische Suche
// AutoSearch
AutoSearch=0
// data.dyn - File (last measured value) will be written
//data.dyn - File (letzter aktuellen Messwertes) wird geschrieben
datadyn=1
// decimal dot for Excel
// Dezimalpunkt fuer Excel
Trennzeichen = ","
// after program start, Excel will be opened
// beim Start wird excel geoeffnet
Excel=0
Column=1
//Wait =1 wait for confirmation and singlemeasurment
//Wait =1 auf Bestaetigen warten und Einzelmessung
Wait=0
// upper Limit fuer AutoGraph
AutoGraph=2000
// change Boardtyp 0=modeva 1=col2
//Boardtyp wechseln 0=modeva 1=col2 zuerst angezeigter und
gesuchter BoardTyp
BoardTyp=0
// Pseudogleitkomma
Gleitkomma=1
Wait=0

[COLORIMETER2]
productid = 8220
vendorid = 152a
AnzeigeText=Colorimeter 2

[modEVA]
productid = c35d
vendorid = 400
AnzeigeText=MTCS Mod Eva
```

⁹ Also do not change the values in the ini-File under [COLORIMETER2] and [modEVA].

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DeviceAnzahl bigger as 1: some devices with the same ID's can be connected.
 Trennzeichen: "." or "," are possible. It is the description of the decimal point by saving.
 Serial=1 a connection to the serial port is possible.

Excel=1

at the start time excel will be running. All measurements will be writing to the excel-form.

A user software session can be started by selecting "mtcs.exe" (START/PROGRAM/modEVA_Rev___/modeva___). The window for USB configuration will open (Figure 12). It contains standard entries for "Vendor_ID" and "Product_ID" representing specific MTCS-ME conventions. These should not be changed.

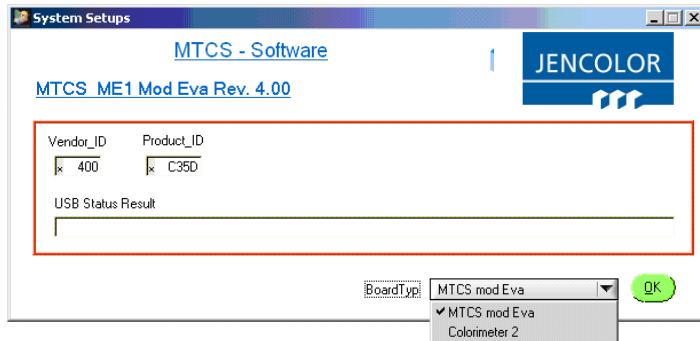
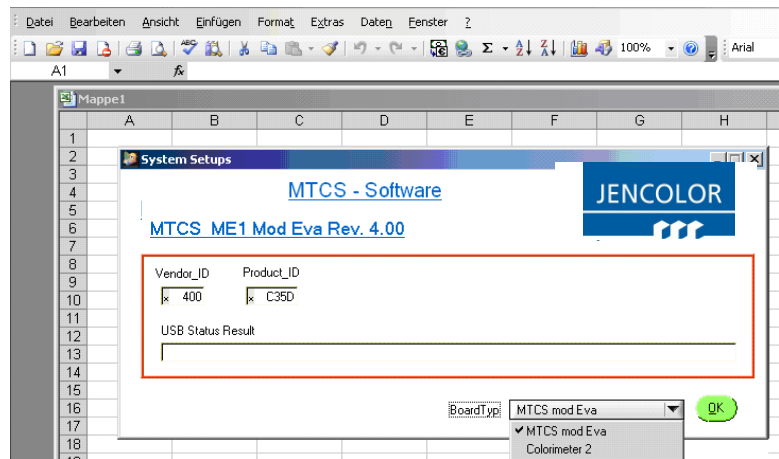


Figure 11, System setups starting window or System Setups – Startup window with excel=1

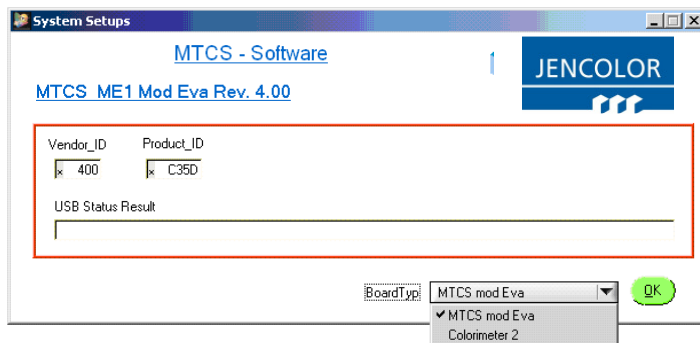


Figure 12, System setups starting window

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Please check whether the window “BoardTyp” includes the right hardware type connected to the PC (MTCS modEVA) and/or correct it.

To check interface communication, click the OK button.

Once communication has been successfully established, a respective message will appear along with the firmware revision number for a short time. (Figure 13).

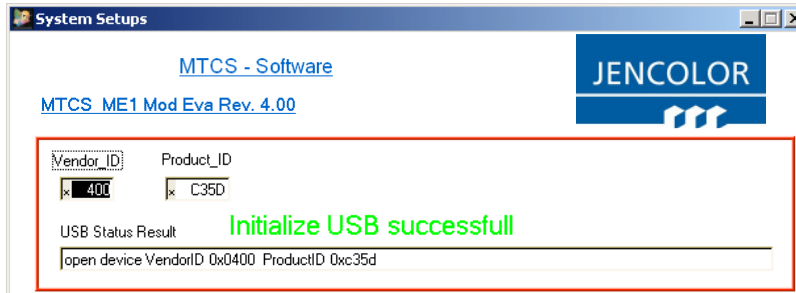


Figure 13, System Setups – USB communication successfully established

The current window then automatically closes and the main window for color measurement (see section: 4.2) opens. If no previously saved configuration is available, the measuring environment configuration window (see section: 4.4) opens instead.

If the software responds “....resetUSB“ in the “USB Status Result“ line, you are advised to terminate the program session, shortly disconnect the USB hardware and restart the software.

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4.2 Color Measurement

Figure 14 shows the main window for color measurement visualization.

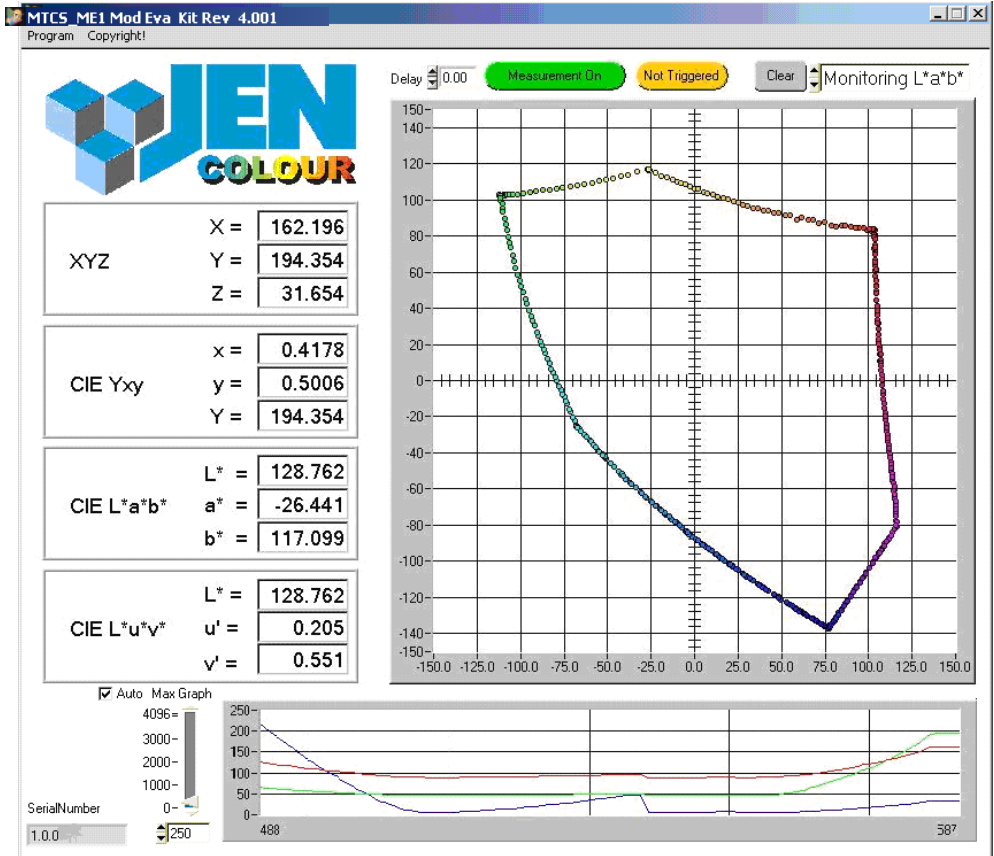


Figure 14, Main window for color measurement

The measured results are represented as

- XYZ standard Tri-stimulus values
- CIE Yxy standard chromaticity
- chart of CIE 1976 L*a*b*
- L*u*v color space.

A measurement can be triggered and cancelled by clicking the “Measurement On / Off” or “ENTER” button, if the focus is at the button “Measurement On / Off”. Depend on the key “Interrupted measurement” in “System configuration” (see chapter 4.4) the program carry out single measurements (after click “Measurement on” the program execute exactly one measurement) or continuous measurements (After click “Measurement on” the program measures until the measurements will be stopped).

By variation of the “delay” time (input in seconds), a desired waiting time between two measurements can be set.

By switching between “not triggered” and “triggered”, you are able to select either a software-controlled data request or a manual data request (using push button at MTSCS-ME1 main board and push button “measurement on” to get the values; the “triggered” function is not available in MTCS-ME1 DARK CCC configuration version)

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For graphical display, you may choose between “Yxy”, “L*a*b*” and “Lu’v’”. A given graphic can be deleted with the “Clear Graph” button or the “DELETE” key.

For measured values varying over time, an extra area is provided at the bottom of the window to display the progression of recent values XYZ (Figure 14). On the left, the display scale can be adjusted by setting a maximum value for the y-axis. It is auto scaled, if “Auto” is selected.

On the left side you can read the serial number of the actually device. DevNr is for the selection of the device. It is only visible, if

- in the ini_File conf.ini the DeviceAnzahl is bigger then 1
- more as 1 device with the same VendorID and ProduktID are connected

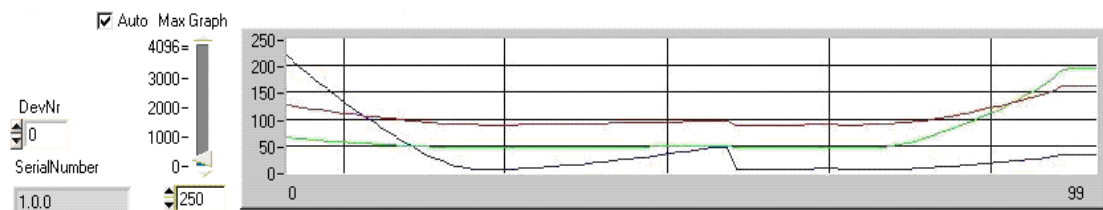


Figure 15, Graph of measured values variation over time

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4.3 Menu Bar

Several functions can be accessed through the “Program” item in the menu bar.



Figure 16, Copyright

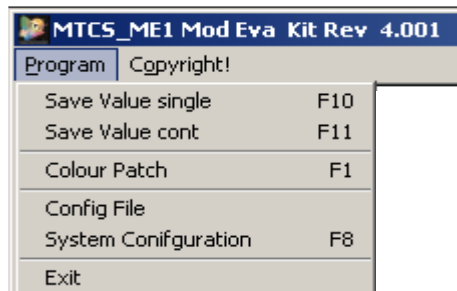


Figure 17, Program

4.3.1 Save Value

Selection of “Save Value” in the “Program” menu bar allows you to save measured data as single values or to dump all measured values continuously into a log file.

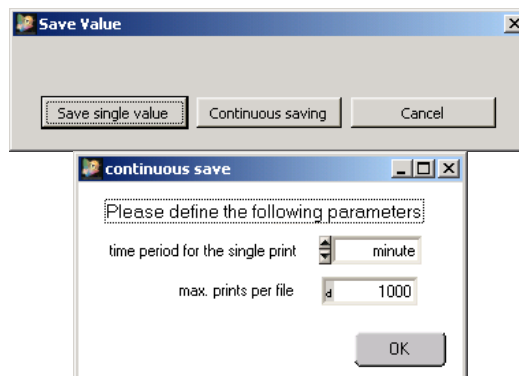


Figure 18, Selection options for saving: single value or continuous saving mode

“Save single value” records the last value in a file. The function may be directly triggered by pushing button F10.

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If “Continuous saving” is selected at this point, the data will be recorded continuous. The interval between two actions (write exactly one value into the file) can be selected over „time period...“ (second, minute, hour)

Before data can be saved, a file name must be specified (Figure 19).

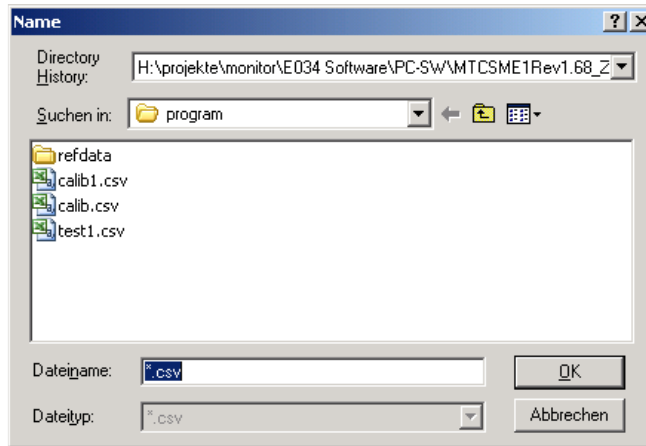


Figure 19, Assignment of file name for measurement data saving

Once a name has been entered and confirmed with OK, the data will be saved to *.csv file.

Continuous data saving can be aborted by clicking “Stop saving“ in the “Program“ menu bar. Before triggering a data save operation via menu bar tools you may add newly measured data to the most recently used file or save these in a new file. A query box as shown in Figure 20 will appear.

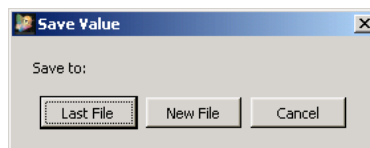


Figure 20, Option box for saving in latest file or in a new file

The .csv file has the following format.

- Line 1: JENCOLOR MTCS Mod Eva Kit Rev 4.001
date and time of creation
- Line 2: data file No.;; X;Y;Z;; x;y;Y;; Lab;; Date ; Time, separated with semicolons
- The data appears from line 3 onwards
The choice of separator (decimal point or comma in real numbers) is recorded in the ini file (see below, Trennzeichen=).

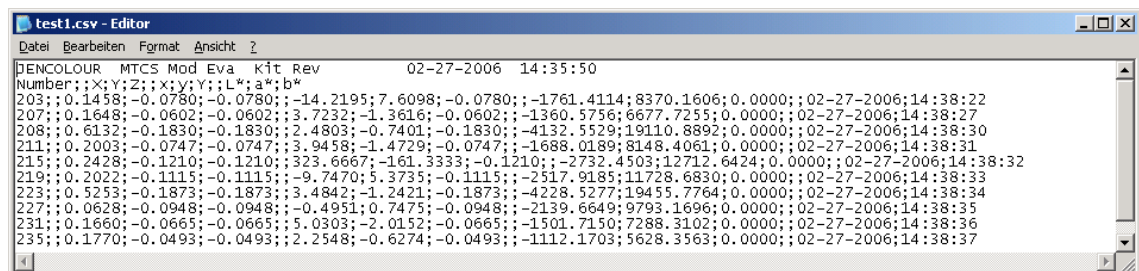


Figure 21, Organization of data saving

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4.3.2 Color Patch

“Color Patch“ is for displaying a particular measured color in an identically colored desktop window. Involved RGB values are also displayed (Figure 22).

For optimized color matching, you need a sensible correction matrix based on ADC values to calculate the right colors for RGB monitor control.



Figure 22, Color patch display

Caution!

Due to different display types and PC and graphic card settings for color management, there may, in some cases, be a noticeable variance in the color reproduction of a measured target.

4.3.3 Config File

Selection of “Config File“ in the “Program“ menu bar allows loading or saving of application specific system configurations and calibration data (see also section 4.4) .

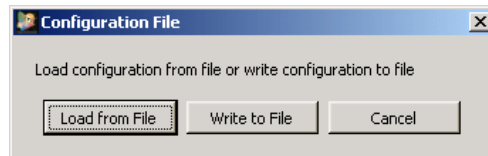


Figure 23, File access options for system configuration

Data saved in a .cfg file which is organized as follows:

Line	Content	File example
1-2	SW Rev. / date / time	
3	Configuration type	
4	LED light intensity	
5-7	Measurement offset	

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Line	Content	File example
8-10	Xn, Yn, Zn for illumination	
11	light compensation on/off	
12	Max. counts of integration interval	
13	Time of integration interval	
14-22	Matrix of base values => XYZ	
23-31	Matrix of base values => RGB monitor	

4.3.4 System Configuration

The sensor system can be set to the appropriate measuring modes with specific parameters using the system configuration. Refer to section 4.4 for a detailed description.

4.3.5 Exit

Clicking “Exit“ in the “Program“ menu bar will terminate the software session.

4.4 Changing System Configuration

A change in the system configuration is only necessary during the initial start-up procedure or following a change in the hardware configuration.

The measuring environment configuration window can be opened by selecting “Program > System Configuration“ in the menu bar or by pushing key F8. It also opens automatically when the software is launched with no configuration data saved in the memory.

The system configuration screen allows the following settings:

- Determination of application (depending on selected sensor board; also refer to sections 3.2 to 3.4)
- Setting of measurement conditions (integration time, average values, illumination LEDs, etc.)
- Definition of colorimetric environmental conditions (offset, CIE illumination, gamma correction)
- Determination of correction matrix for color space transformation by target specific calibration
- On-board memory management

If no configuration data is stored on-board, (“no saved configuration“), a screen as shown in Figure 24 and Figure 25 will appear immediately following USB initialization.



Figure 24, EEPROM without data

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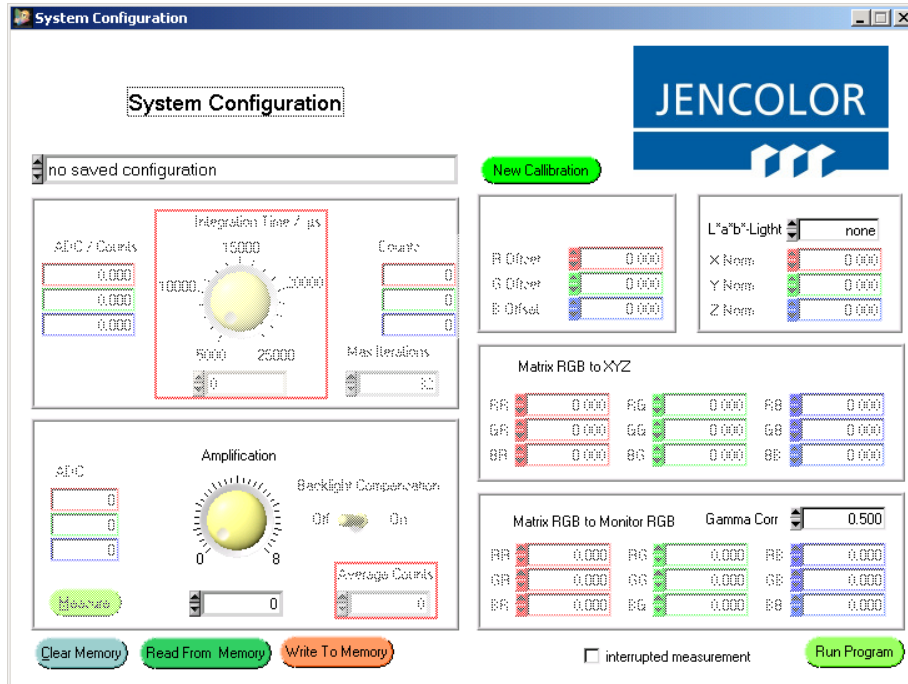


Figure 25, System configuration starting screen

Which application is the right choice depends on the currently installed sensor board. It must be typed into the top entry field.

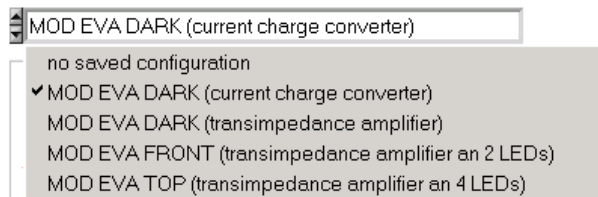


Figure 26, Configuration of application

Depending on the selected application, particular fields will be enabled for setting changes.

Configuration data management in the on-board memory is achieved with the three buttons “Clear Memory”, “Read From Memory” and “Write To Memory”.

Following a change in configuration, the “Run Program” button will be disabled until the data have been saved with “Write To Memory” or been reset with “Read From Memory”.

On successful system configuration, click “Run Program” or push key F8 to return to measuring mode.

4.4.1 Configuration for MTCS-ME1 DARK (Current-To-Charge Converter)

The MTCS-ME1 DARK (current-to-charge converter) sensor board is primarily used for measurement of light sources, e.g. illumination LEDs or monitors, too. For integration of sources with a potential variance over time (e.g. CRT monitors), the integration time can be set to a value from $5000\mu s$ to $25000\mu s$. Accurate synchronization between the

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integration time setting and the frequency of the light source being measured is crucial for achieving a color detection that is duly matched to the human eye's inertia.

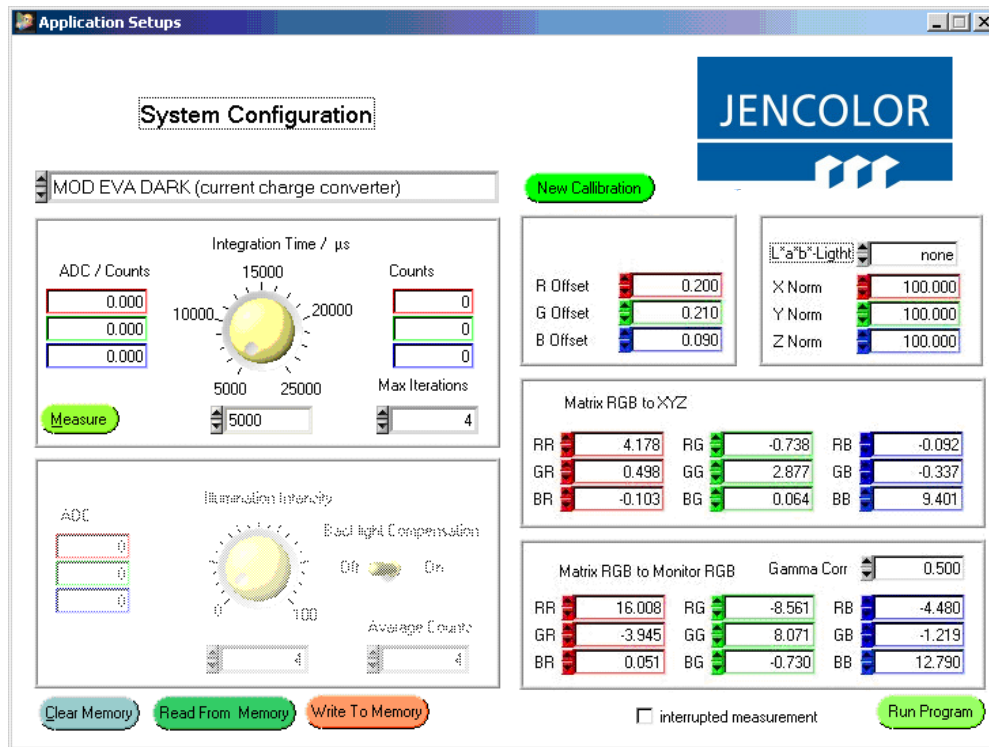


Figure 27, Sample configuration for MTCS-ME1 DARK (current-to-charge converter)

For system configuration, you should direct the sensor at a white surface. When measuring monitors, the screen with an appropriately bright background color can be used.

The “Integration Time/ μ s” field will register the integration time. It can be varied from 5.000 μ s to 25.000 μ s. This corresponds to synchronization with the frequencies of 200 Hz to 40 Hz sources (such as CRT monitor).

A measurement lasts for a multiple of the specified integration time. The measured value (“ADC / Counts”) represents the integral signal level excursion, divided by the number of frame refresh cycles (counts).

On selection of “Max Iterations”, the termination condition - the maximum number of frame refreshes to be performed - is determined for a measuring cycle. A change in a parameter will immediately trigger a measurement with the current set of measuring conditions and display the measured values (“ADC / Counts”) and the number of required iterations (“Counts”) accordingly.

Key „Interrupted Measurement“ is responsible for selecting the function single measurement (exactly one measured value) or continuous measurement (measurement until the process will be stopped - see chapter 4.2).

Your selection for integration time should be such that at least two iterations are reflected in the “Counts” per color, when measuring the brightest source (poor white).

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When all measurement settings have been made, the system can be calibrated with the help of a target-matched correction matrix. For a more detailed description, refer to section 4.4.2.

4.4.2 Configuration for MTCS-ME1 DARK TIA (transimpedance amplifier), Front and Top

MTCS-ME1 DARK (transimpedance amplifier), FRONT and TOP configurations are employed to measure reflective samples or constantly bright sources. Configuration settings can be made using the active fields shown in Figure 28.

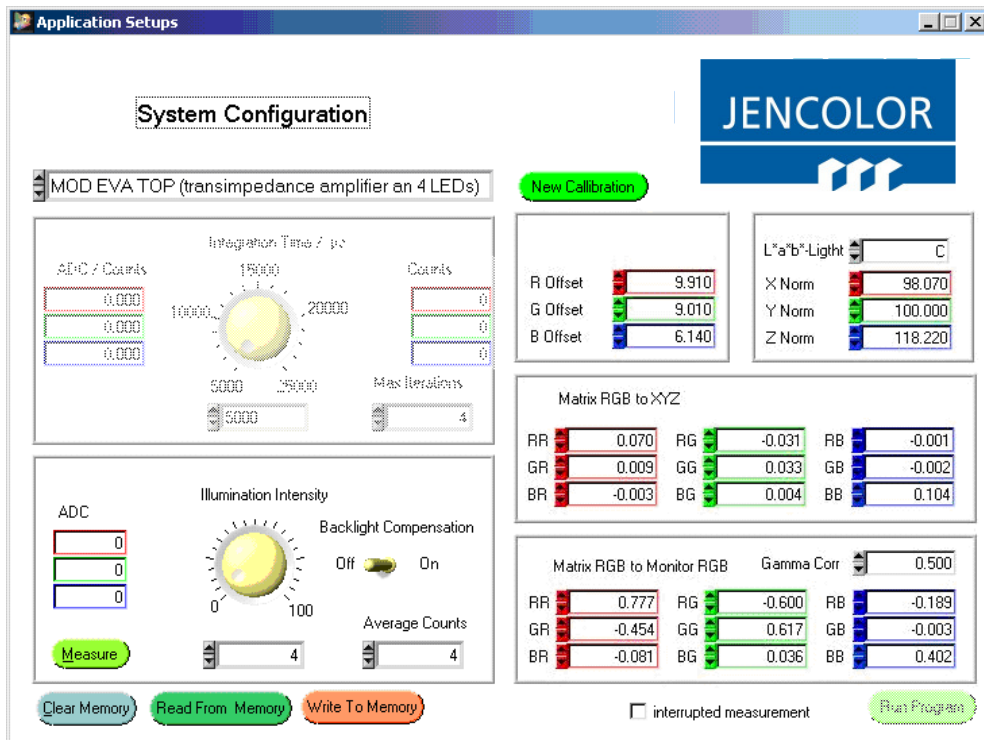


Figure 28, Sample configuration with MTCS-ME TOP

The brightness of a LED illuminator can be adjusted using the rotary “Illumination Intensity” button (only for MTCS-ME1 FRONT and MTCS-ME1 TOP).

“Backlight Compensation“ allows a dynamic background and stray light suppression. “Average Counts“ determines the number of measured values to be included in averaging.

Entering a measuring condition parameter will immediately trigger a measurement and display the measured values (“ADC“) of all three channels accordingly.

4.5 Target-Matched Calibration

By clicking the “New Calibration“ button, the system can be calibrated to a known set of targets (Figure 28). As part of calibration, the actual system values will be determined for targets with known XYZ values. These provide the input for calculation of the offset values and the final correction matrix.

Calibration starts with the following screen:

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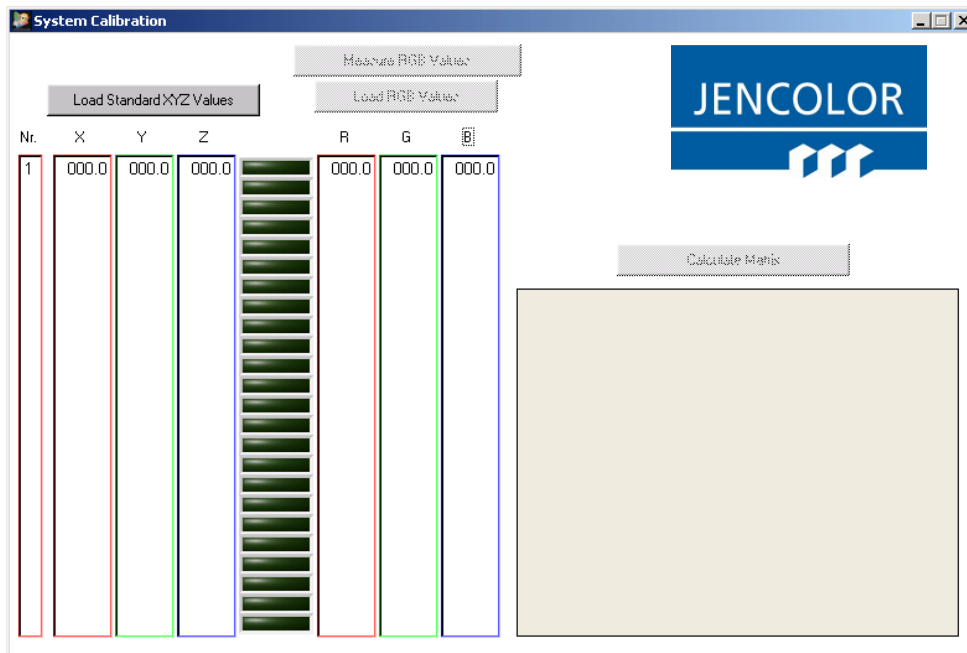


Figure 29, System calibration starting screen

Clicking the “Load Standard XYZ-Value“ button loads a known and measured target data set. This data set may comprise a number between at least 3 and a maximum of 24 XYZ and RGB target values for representation on the monitor.

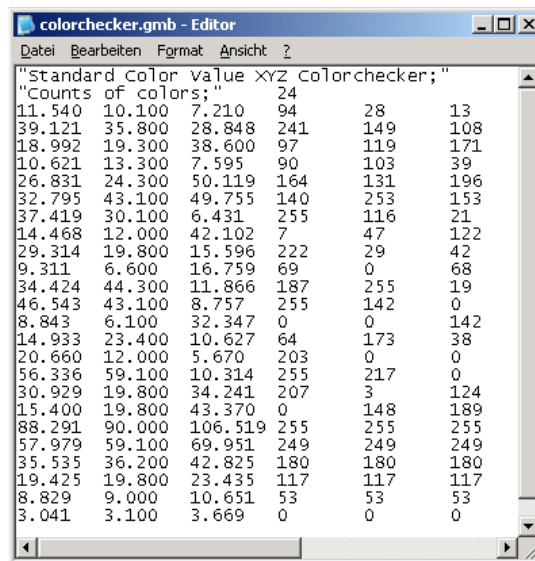


Figure 30, Target data set

For reflectance measurement, a data set can be calculated, for example, using the provided color space data of a color checker from Gretag Macbeth (Figure 31).

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Figure 31, Color checker from GretagMacbeth

The use of other targets requires prior knowledge of their XYZ values. For luminous objects, a corresponding target file can be created by performing a metrological test run with a spectrometer.

A loaded target file is displayed in tabular form including all XYZ values as well as the RGB monitor color (Figure 30).

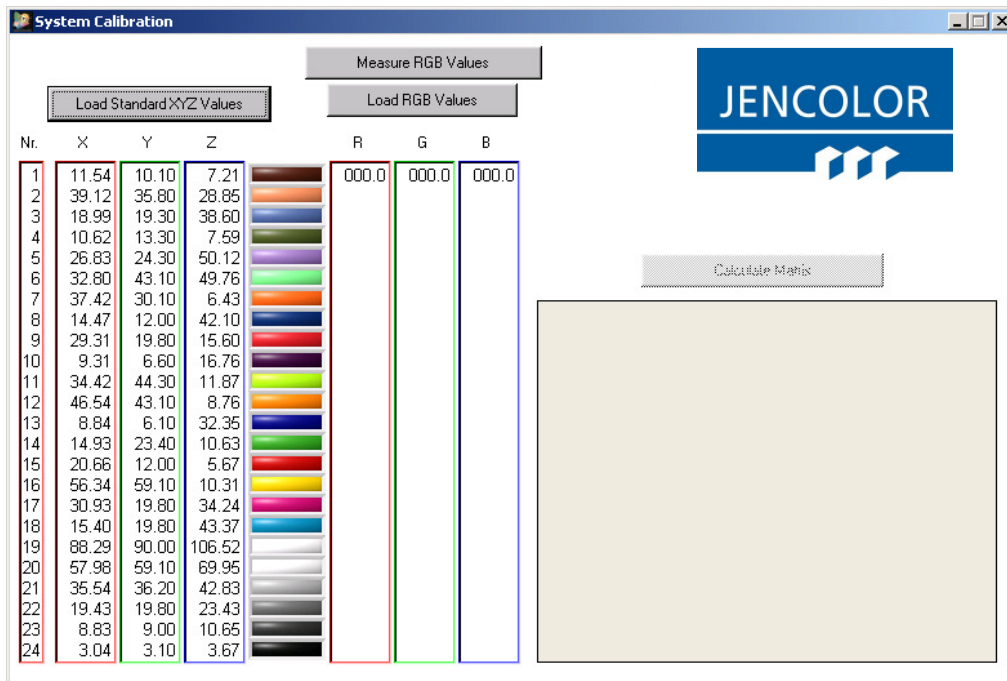


Figure 32, System calibration nominal value

If calibration is performed using a calibrated monitor, the actual values will be determined automatically. The sensor must be positioned in the middle of the color area or in front of the separate color patch field for this purpose. Calibration can then be triggered via “Measure RGB Values“. During calibration, the monitor’s RGB values, which are saved in the file, are set consecutively and their corresponding actual values are determined.

For calibration to a reflective target set, the sensor must be successively placed onto each target color to be measured. By pressing “Measure“, the respective actual value will be determined (Figure 34).

A “Repeat“ function is provided for correction of the most recent last measurement value. The calibration mode can be cancelled with “Break“. The program returns to “System Configuration”

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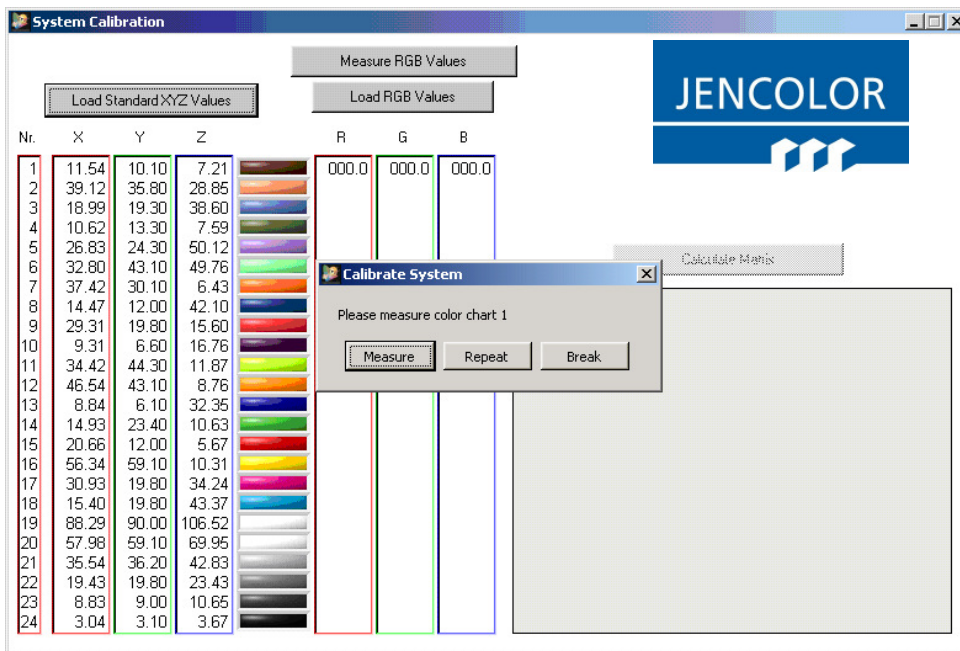


Figure 33, System calibration – determination of actual values

Once all 24 actual values have been recorded, their data is saved and the resulting offset values are calculated.

An already existing file of actual values can also be loaded via “Load RGB Values”.

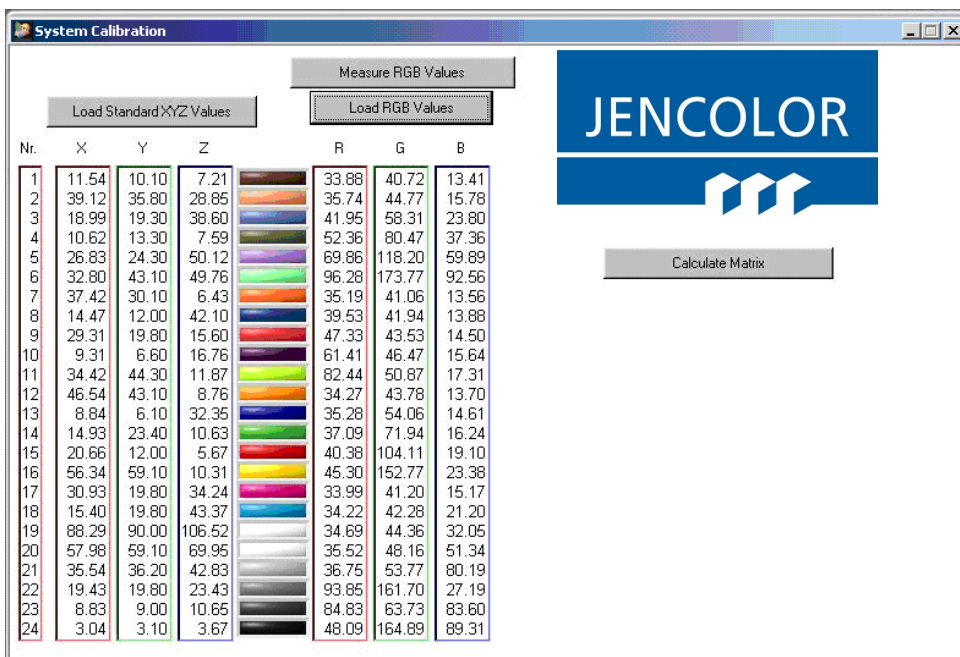


Figure 34, System calibration – calculation of matrix

As soon as offset-corrected values are available, the “Calculate Matrix” button will be enabled (Figure 34). By clicking this button, the required correction matrices will be calculated, designating the end of calibration. The software returns to the “System Configuration “ screen, displaying the determined offset values and matrices.

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For Lab values calculated during the measurement, the type of illumination being calibrated remains to be specified (“L*a*b*Light“ in Figure 27).

Finally, the newly obtained set of calibration data can be saved on the on-board memory by clicking “Write to Memory“. It will automatically be restored with each restart without having to perform another calibration procedure.

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Available components of modEVA

Type	Description
MTCS-ME1 modEVA Main	modEVA: Main board with μ C and USB interface, (ROHS on request) Article-No.: V522A100030
MTCS-ME1 modEVA(front) Main	modEVA(front): Main board for FRONT Modul with μ C and USB interface, (ROHS on request) Article-No.: V522A100031
MTCS-ME1 modEVA Soft	modEVA: Software USB driver (f. USB 2.0) and PC test software Article-No.: V522A100020
MTCS-ME1 modEVA DLL	modEVA: API program interface (DLL) Article-No.: V522A100022
MTCS-ME1 modEVA USB	modEVA: Cable USB 59204-9401; 1m, Plug Type A/mini-B Article-No.: V522A100021
MTCS-ME1 modEVA TOP	modEVA: TOP plug-module with 4xLED, Sensor-IC, circular hole and signal electronic, (ROHS on request) Article-No.: V522A100040
MTCS-ME1 modEVA FRONT	modEVA: FRONT plug-module with 2xLED, Sensor-IC, circular hole and signal electronic, (ROHS on request) Article-No.: V522A100050
MTCS-ME1 modEVA DARK CCC	modEVA: DARK CCC plug-module with Sensor-IC, circular hole and signal electronic - Current-Charge-Converter, (ROHS on request) Article-No.: V522A100060
MTCS-ME1 modEVA DARK TIA	modEVA: DARK TIA plug-module with Sensor-IC, circular hole and signal electronic (Transimpedance amplifier) Article-No.: V522A100070
MTCS-ME1 modEVA LWL DARK	modEVA additional circular hole for DARK Article-No.: V522A100080
MTCS-ME1 modEVA LWL FRONT	modEVA additional circular hole for FRONT Article-No.: V522A100090
MTCS-ME1 modEVA LWL TOP	modEVA additional circular hole for TOP Article-No.: V522A100100