E5-648-C446x electronic preset counter with four presets (relays) LCD negative, red-green backlighting
## Contents

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preface</td>
<td>3</td>
</tr>
<tr>
<td>2. Safety instructions and warnings</td>
<td>3</td>
</tr>
<tr>
<td>2.1 Use according to the intended purpose</td>
<td>3</td>
</tr>
<tr>
<td>2.2 Mounting in a control panel</td>
<td>3</td>
</tr>
<tr>
<td>2.3 Electrical Installation</td>
<td>3</td>
</tr>
<tr>
<td>3. Description</td>
<td>3</td>
</tr>
<tr>
<td>4. Display/operating elements</td>
<td>4</td>
</tr>
<tr>
<td>5. Inputs</td>
<td>4</td>
</tr>
<tr>
<td>5.1 INP A, INP B</td>
<td>4</td>
</tr>
<tr>
<td>5.2 RESET</td>
<td>4</td>
</tr>
<tr>
<td>5.3 GATE</td>
<td>4</td>
</tr>
<tr>
<td>5.4 LOCK INPUT</td>
<td>4</td>
</tr>
<tr>
<td>5.5 MPI</td>
<td>4</td>
</tr>
<tr>
<td>6. Outputs</td>
<td>4</td>
</tr>
<tr>
<td>6.1 Output 1 and output 3</td>
<td>4</td>
</tr>
<tr>
<td>6.2 Output 2 and output 4</td>
<td>4</td>
</tr>
<tr>
<td>6.3 Active outputs</td>
<td>4</td>
</tr>
<tr>
<td>7. Programming</td>
<td>4</td>
</tr>
<tr>
<td>7.1 Entering the programming</td>
<td>4</td>
</tr>
<tr>
<td>7.2 Choice of main menus</td>
<td>4</td>
</tr>
<tr>
<td>7.3 Entering a sub-menu</td>
<td>4</td>
</tr>
<tr>
<td>7.4 Selecting the menu items</td>
<td>5</td>
</tr>
<tr>
<td>7.5 Setting the menu items</td>
<td>5</td>
</tr>
<tr>
<td>7.6 Accepting the setting</td>
<td>5</td>
</tr>
<tr>
<td>7.7 Ending the programming</td>
<td>5</td>
</tr>
<tr>
<td>7.8 Programming menu</td>
<td>5</td>
</tr>
<tr>
<td>7.8.1 Default parameters</td>
<td>5</td>
</tr>
<tr>
<td>7.8.2 Parameter sets</td>
<td>5</td>
</tr>
<tr>
<td>7.8.3 Setting the Basic function</td>
<td>6</td>
</tr>
<tr>
<td>7.8.4 Pulse counter</td>
<td>6</td>
</tr>
<tr>
<td>7.8.5 Tacho/frequency meter</td>
<td>8</td>
</tr>
<tr>
<td>7.8.6 Timer</td>
<td>9</td>
</tr>
<tr>
<td>7.9 Setting the presets</td>
<td>13</td>
</tr>
<tr>
<td>7.9.1 Setting via decade keys</td>
<td>13</td>
</tr>
<tr>
<td>7.9.2 Setting with Teach-In function</td>
<td>13</td>
</tr>
<tr>
<td>7.10 Set function</td>
<td>13</td>
</tr>
<tr>
<td>8. Error message</td>
<td>13</td>
</tr>
<tr>
<td>9. Connections</td>
<td>14</td>
</tr>
<tr>
<td>9.1 Signal and control inputs</td>
<td>14</td>
</tr>
<tr>
<td>9.2 Supply voltage and outputs</td>
<td>14</td>
</tr>
<tr>
<td>10. Technical data</td>
<td>14</td>
</tr>
<tr>
<td>10.1 General data</td>
<td>14</td>
</tr>
<tr>
<td>10.2 Pulse counter</td>
<td>14</td>
</tr>
<tr>
<td>10.3 Tacho/frequency meter</td>
<td>14</td>
</tr>
<tr>
<td>10.4 Timer</td>
<td>14</td>
</tr>
<tr>
<td>10.5 Signal and control inputs</td>
<td>15</td>
</tr>
<tr>
<td>10.6 Outputs</td>
<td>15</td>
</tr>
<tr>
<td>10.7 Supply voltage</td>
<td>15</td>
</tr>
<tr>
<td>10.8 Sensor supply voltage</td>
<td>15</td>
</tr>
<tr>
<td>10.9 Climatic conditions</td>
<td>15</td>
</tr>
<tr>
<td>10.10 EMC</td>
<td>15</td>
</tr>
<tr>
<td>10.11 Device safety</td>
<td>15</td>
</tr>
<tr>
<td>10.12 Mechanical data</td>
<td>15</td>
</tr>
<tr>
<td>10.13 Connections</td>
<td>15</td>
</tr>
<tr>
<td>11. Scope of delivery</td>
<td>16</td>
</tr>
<tr>
<td>12. Ordering codes</td>
<td>16</td>
</tr>
<tr>
<td>13. Frequencies (typical)</td>
<td>16</td>
</tr>
<tr>
<td>13.1 Pulse counter</td>
<td>16</td>
</tr>
<tr>
<td>13.2 Frequency meter</td>
<td>16</td>
</tr>
<tr>
<td>14. Input modes: Pulse counting</td>
<td>17</td>
</tr>
<tr>
<td>15. Input modes: Timing</td>
<td>19</td>
</tr>
<tr>
<td>16. Input modes: Frequency meter</td>
<td>20</td>
</tr>
<tr>
<td>17. Output operations</td>
<td>21</td>
</tr>
<tr>
<td>18. Dimensional drawings</td>
<td>22</td>
</tr>
</tbody>
</table>
1. Preface
Please read this instruction manual carefully before installation and start-up. Please observe all warnings and advice, both for your own safety and for general plant safety. If the device is not used in accordance with this instruction manual, then the intended protection can be impaired.

2. Safety instructions and warnings
Please use the device only if its technical condition is perfect. It should be used only for its intended purpose. Please bear in mind safety aspects and potential dangers and adhere to the operating instructions at all times.

2.1 Use according to the intended purpose
The preset counter detects and measures pulses, times and frequencies up to max. 60 kHz and offers a wide variety of different operating modes. At the same time, the preset counter processes programmed presets. Use for any purpose over and beyond this will be deemed as not in accordance with its intended purpose and thus not complying with the requirements.

The application area for this device lies in industrial processes and controls, in the fields of manufacturing lines for the metal, wood, plastics, paper, glass, textile and other like industries. Overvoltages at the terminals of the device must be kept within the limits of overvoltage Category II.

The device must only be operated when mounted in a panel in the correct way and in accordance with the section Technical Data.

Correct operation of the device requires the mandatory use of the appropriate external safety fuse. Advice concerning the recommended fuse-protection can be found under Technical Data.

The device is not suitable for use in hazardous areas and for areas excluded in EN 61010 Part 1.

If the device is used to monitor machines or processes in which, in the event of a failure of the device or an error made by the operator, there might be the risk of damaging the machine or causing an accident to the operators, then it is your responsibility to take the appropriate safety measures.

2.2 Mounting in a control panel

**CAUTION!**
MOUNT THE DEVICE AWAY FROM HEAT SOURCES AND AVOID DIRECT CONTACT WITH CORROSIVE LIQUIDS, HOT STEAM OR SIMILAR.

Mounting instructions
1. Remove mounting clip from the device.
2. Insert the device from the front into the panel cut-out, ensuring the front-panel gasket is correctly seated.
3. Slide the fixing clip from the rear onto the housing, until the latching lugs have snapped into place.

2.3 Electrical installation

**DANGER!**
THE DEVICE MUST BE DISCONNECTED FROM THE POWER SUPPLY, BEFORE ANY INSTALLATION OR MAINTENANCE WORK IS CARRIED OUT. AC-POWERED DEVICES MUST ONLY BE CONNECTED TO THE LOW-VOLTAGE NETWORK VIA A SWITCH OR CIRCUIT BREAKER. INSTALLATION OR MAINTENANCE WORK MUST ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL.

Advice on noise immunity
All connections are protected against external sources of interference. The installation location should be chosen so that inductive or capacitive interference does not affect the device or its connecting lines. Interference (e.g. from switch-mode power supplies, motors, clocked controllers or contactors) can be reduced by means of appropriate cable routing and wiring.

Measures to be taken:
- Use only shielded cable for signal and control lines. Connect cable shield at both ends
- The conductor cross-section of the cables should be a minimum of 0.4 mm²
- The shield connection to the equipotential bonding should as short as possible and with a contact area as large as possible (low-impedance)
- Only connect the shields to the control panel, if the latter is also earthed
- Install the device as far away as possible from noise-containing cables
- Avoid routing signal or control cables parallel to power lines
- Cables and their insulation should be in accordance with the intended temperature and voltage ranges

3. Description
- Six-digit multifunction LCD display
- Easy-to-read two-line LCD-display with annunciators for both the displayed preset and the status of the outputs
- Simultaneous display of the actual value and of the presets or auxiliary counters
- Versions with/without backlight display
- Add/Sub. preset counter with four presets
- Relay outputs
- Easy-to-program
- Simple preset entry via the front keys or via the Teach-In function
- Step preset
- Pulse, frequency, time or batch counter
- Preset counter, Batch counter or Total counter (cumulative count)
- Set function for pulse and time counter
- Multiplication (00.0001–99.9999) and division factor (01.0000–99.9999) for pulse counter and frequency meter
- Averaging and start delay for frequency meter
- Input modes:
  - Pulse counter: cnt.dir, up.dn, up.up, quad, quad2, quad4, A/B, (A-B)/Ax100%
  - Frequency meter: A, A – B, A + B, quad, A/B, (A-B)/Ax100%
- Output operations:
  - Add, Sub, AddAr, SubAr, AddBat, AddTot
- Four-stage RESET-Mode
- Three-stage keypad locking (Lock)
- MPI input for Display Latch, Teach-In function or Set function
- Supply voltage 90–260 Vac or 10–30 Vdc
4. Display/Operating elements

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-6</td>
<td>Decade key T1–T6</td>
</tr>
<tr>
<td>P</td>
<td>Prog/Mode key</td>
</tr>
<tr>
<td>R</td>
<td>Reset key</td>
</tr>
<tr>
<td>8</td>
<td>Current count value/main counter</td>
</tr>
<tr>
<td>9</td>
<td>Preset value/Total count/Batch counter</td>
</tr>
<tr>
<td>10</td>
<td>Run display for timer</td>
</tr>
<tr>
<td>11</td>
<td>Shows which preset value is being displayed</td>
</tr>
<tr>
<td>12</td>
<td>Shows which preset output is active</td>
</tr>
<tr>
<td>Pr</td>
<td>Keys necessary for programming the parameters (highlighted in grey)</td>
</tr>
</tbody>
</table>

5. Inputs

5.1 INP A, INP B
- Signal inputs: function according to operating mode
- Max. frequency 55 kHz, can be damped in the programming menu to 30 Hz
- Pulse counter: count inputs
- Frequency meter: frequency inputs
- Timer: start input or start/stop inputs

5.2 Reset
- Dynamic reset input: resets the pulse counter or timer to zero (adding mode) or to preset value 2 (subtracting mode). The reset input can be inhibited in the programming menu
- Pulse counter: RESET input
- Frequency meter: no function
- Timer: RESET input

5.3 Gate
- Static gate input: function depending on operating mode
- Pulse counter: no counting while active
- Frequency meter: no counting while active
- Timer: no time measurement while active (Gate.hi); no time measurement while not active (Gate.Lo)

5.4 Lock input
- Static keypad lock input for presets or programming. Lock-out level can be set in the programming menu

5.5 MPI
- Input. Programmable as Display Latch, Set or Teach-In input

6. Outputs

6.1 Output 1 and output 3
- Relay with potential-free make (NO) contact

6.2 Output 2 and output 4
- Relay with potential-free changeover contact

6.3 Active outputs
An active output will be shown on the display as \( \text{active} \), \( \text{not active} \) or \( \text{inactive} \). For safety switching the relay outputs can be inverted, i.e. the relay will be de-energized when the presets are reached. To do this, the parameters Pr.OUT1 to Pr.OUT4 must be set to \( \text{active} \) (for permanent signal) or \( \text{not active} \) or \( \text{inactive} \) (for timed signal).

7. Programming

7.1 Entering the program
- Press the Reset key and Prog/Mode key simultaneously for 3s
- The security prompt appears in the display
- Programming can be exited again using the Prog/Mode key

7.2 Choice of main menus
- The menus are selected using the keys T2 (next) and T1 (back)

7.3 Entering a sub-menu
- The sub-menu is opened with the Prog/Mode key and the first menu item is displayed
7.4 Selecting the menu items

The Prog/Mode key is used to select a menu item within the sub-menu.

7.5 Setting the menu items

The T2 key is used to select the individual settings for the menu items.

When setting count values, each decade has a key assigned to it. Each time the key is pressed, the value increments by one.

7.6 Accepting the setting

Pressing the Prog/Mode key causes the current setting to be accepted. Programming then switches to the next menu item.

7.7 Ending the programming

During programming, it is possible to exit the programming at each menu item by pressing the reset key.

Press the Reset key.

The security prompt appears in the display.

Pressing the Prog/Mode key acknowledges this prompt and causes the programming menu to start again from the beginning. The previously programmed values are preserved. These can now be changed or checked again.

Pressing the decade key T2 selects the termination of the programming.

The security prompt appears in the display.

Pressing the Prog/Mode key acknowledges this prompt and terminates the programming; the modified settings are saved in the EEPROM.

The text SAVE is displayed for 2s.

7.8 Programming menu

7.8.1 Default parameters

Three default parameter sets have been permanently stored; these can be adapted as required. With each acknowledgment of the parameter sets, all parameters will be reset to the values listed in the table.

The dEFAuL PUSER can be freely programmed.

7.8.2 Parameter sets

Factory settings are highlighted in grey.

<table>
<thead>
<tr>
<th>Display</th>
<th>PSet 1</th>
<th>PSet 2</th>
<th>PSet 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Func</td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
</tr>
<tr>
<td>InfPrOL</td>
<td>PrP</td>
<td>PrP</td>
<td>PrP</td>
</tr>
<tr>
<td>FiltEr</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>Count</td>
<td>Cnt-dir</td>
<td>updn</td>
<td>Quad</td>
</tr>
<tr>
<td>MPI</td>
<td>Latch</td>
<td>Latch</td>
<td>Set</td>
</tr>
<tr>
<td>Loc.InP</td>
<td>PrG</td>
<td>PrG</td>
<td>PrG</td>
</tr>
<tr>
<td>ModE</td>
<td>Add</td>
<td>Sub</td>
<td>AddAr</td>
</tr>
<tr>
<td>FActo</td>
<td>01.0000</td>
<td>01.0000</td>
<td>01.0000</td>
</tr>
<tr>
<td>dIVSo</td>
<td>01.0000</td>
<td>01.0000</td>
<td>01.0000</td>
</tr>
<tr>
<td>dP</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>SetPt</td>
<td>000000</td>
<td>000000</td>
<td>0000.00</td>
</tr>
<tr>
<td>Color</td>
<td>red.Grn</td>
<td>red.Grn</td>
<td>red.Grn</td>
</tr>
<tr>
<td>rESmd</td>
<td>Man.EL</td>
<td>Man.EL</td>
<td>Man.EL</td>
</tr>
<tr>
<td>Pr.OUt 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t.OUt 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr.OUt 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t.OUt 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr.OUt 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t.OUt 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr.OUt 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t.OUt 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
78.3 Setting the basic function

Basic function menu

Programming menu
Pulse counter (7.8.4)

Programming menu
Timer/Hour meter (7.8.6)

Programming menu
Tacho/Frequency meter (7.8.5)

78.4 Pulse counter

78.4.1 Main menu for Signal and Control inputs
Main menu for programming the signal and control inputs

Input polarity
PNP: switching to Plus for all inputs in common

NPN: switching to 0V for all inputs in common

Filter for signal inputs InpA and InpB
Maximum count frequency

Damped to approx. 30 Hz (for control with mechanical contacts)

Count Input mode

Count/Direction
INP A: count input
INP B: count direction input

Differential counting [A – B]
INP A: count input add
INP B: count input sub

Totalizing [A + B]
INP A: count input add
INP B: count input add

Quadrature input
INP A: count input 0°
INP B: count input 90°

Quadrature with pulse doubling
INP A: count input 0°
INP B: count input 90°
Each pulse edge of INP A will be counted

Quadrature x4
INP A: count input 0°
INP B: count input 90°
Each pulse edge of INP A and INP B will be counted.

Ratio measurement [A/B]
INp A: count input A
INp B: count input B

Percentage differential counting [(A – B)/A in %]
INp A: count input A
INp B: count input B

User input

When the MPI input is activated, the display is “frozen” and remains “frozen” until the MPI input is deactivated. Internally the preset counter continues counting

When the MPI input is activated, the current count value for the preset that has just been selected will be adopted as the new preset value. See also 7.9

When the MPI input is activated, the preset counter will be set to the value specified in the parameter SEtPt. See also 7.10
Lock input

When the Lock input is activated the programming is inhibited

When the Lock input is activated the setting of the preset values is inhibited

When the Lock input is activated the setting of the preset values and the programming are both inhibited

7.8.4.2 Main menu for output operations

Main menu for determining the operation of the outputs

Count mode ADD

Outputs active when count status ≥ preset value
Reset to zero

Count mode SUBTRACT

Outputs 1, 3 and 4 active when count status ≤ preset values 1, 3 and 4
Output 2 active when count status ≤ 0
Reset to preset 2

Count mode ADDING with automatic reset

Outputs 1, 3 and 4 active when count status ≥ preset values 1, 3 and 4
Output 2 (timed signal) active when count status = preset value 2
Automatic reset to zero when count status = preset value 2
Reset to zero

Count mode SUBTRACTING with automatic reset

Outputs 1, 3 and 4 active when count status ≤ preset values 1, 3 and 4
Output 2 (timed signal) active when count status = 0
Automatic reset to preset 2 when count status = 0
Reset to preset 2

7.8.4.3 Main menu for configuration

Main menu for matching the input pulses and display

Multiplication factor

Multiplication factor can be programmed from 0.0001 to 99.9999. The setting 00.0000 will not be accepted

Division factor

Division factor can be programmed from 01.0000 to 99.9999. The setting <01.0000 will not be accepted

Decimal point setting

Decimal point (only optical function)
0 no decimal place
0.0 1 decimal place
0.00 2 decimal places
0.000 3 decimal places
0.0000 4 decimal places
0.00000 5 decimal places

Set value

Set value can be programmed from –999999 to 999999
A previously programmed decimal point will be displayed
**Display color (for device E5-648-C446x)**

- Display color
  - Upper line: red
  - Lower line: red

- Display color
  - Upper line: red
  - Lower line: green

**7.8.4.4 Main menu for reset mode**

- Setting the reset mode

- Manual reset (with red key) and electrical reset (reset input)

- No reset possible (red key and reset input inhibited)

- Only electrical reset possible (reset input)

- Only manual reset possible (red key)

**7.8.5 Tacho/frequency meter**

**7.8.5.1 Main menu for Signal and Control inputs**

Main menu for programming the signal and control inputs

**Input polarity**

- PNP: switching to Plus for all inputs in common

- NPN: switching to 0V for all inputs in common

**Filter for signal inputs Inp A and Inp B**

- Maximum count frequency

- Damped to approx. 30 Hz (for control with mechanical contacts)

**Input mode frequency measurement**

- Simple frequency measurement
  - Inp A: Frequency input
  - Inp B: No function

- Differential measurement [A – B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Total measurement [A + B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Frequency measurement with direction recognition [Quad]
  - Inp A: Frequency input 0°
  - Inp B: Frequency input 90°

- Ratio measurement [A/B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Percentage differential measurement [(A-B)/A in %]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

**User input**

- When the MPI input is activated, the display is “frozen” and remains “frozen” until the MPI input is deactivated. Internally the frequency meter continues running

- When the MPI input is activated, the current frequency for the preset that has just been selected will be adopted as the new preset value. See also 7.9

**Display color (for device E5-648-C446x)**

<table>
<thead>
<tr>
<th>Display color</th>
<th>Upper line: red</th>
<th>Lower line: red</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display color</td>
<td>Upper line: red</td>
<td>Lower line: green</td>
</tr>
</tbody>
</table>

**Filter for signal inputs Inp A and Inp B**

<table>
<thead>
<tr>
<th>Filter setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter off</td>
<td>Maximum count frequency</td>
</tr>
<tr>
<td>Filter on</td>
<td>Damped to approx. 30 Hz (for control with mechanical contacts)</td>
</tr>
</tbody>
</table>

**Input mode frequency measurement**

- Simple frequency measurement
  - Inp A: Frequency input
  - Inp B: No function

- Differential measurement [A – B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Total measurement [A + B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Frequency measurement with direction recognition [Quad]
  - Inp A: Frequency input 0°
  - Inp B: Frequency input 90°

- Ratio measurement [A/B]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

- Percentage differential measurement [(A-B)/A in %]
  - Inp A: Frequency input A
  - Inp B: Frequency input B

**User input**

- When the MPI input is activated, the display is “frozen” and remains “frozen” until the MPI input is deactivated. Internally the frequency meter continues running

- When the MPI input is activated, the current frequency for the preset that has just been selected will be adopted as the new preset value. See also 7.9
**Lock input**
- When the Lock input is activated the programming is inhibited
- When the Lock input is activated the setting of the preset values is inhibited
- When the Lock input is activated the setting of the preset values and the programming are both inhibited

**7.8.5.2 Main menu for configuration**
- Main menu for matching the input pulses and display

**Multiplication factor**
- Multiplication factor can be programmed from 00.0001 to 99.9999. The setting 00.0000 will not be accepted

**Division factor**
- Division factor can be programmed from 01.0000 to 99.9999. The setting <01.0000 will not be accepted

**Display mode**
- Calculation and display of the frequency/speed in 1/s
- Calculation and display of the frequency/speed in 1/min

**Decimal point setting**
- Decimal point (determines the resolution)
  - 0: no decimal place
  - 0.0: 1 decimal place
  - 0.00: 2 decimal places
  - 0.000: 3 decimal places

**Moving average**
- Moving average calculated (AVG)
  - AVG 2: over 2 measurements
  - AVG 5: over 5 measurements
  - AVG 10: over 10 measurements
  - AVG 20: over 20 measurements

**Start delay**
- Programmable from 00.0 to 99.9s
  - At the start of a measurement the measurement results within this time-period are ignored

**Waiting time**
- Programmable from 00.1 to 99.9s
  - This value specifies how much time should elapse, after the last valid edge, before zero is to be displayed

**Display color (for device E5-648-C446x)**
- Display color
  - Upper line: red
  - Lower line: green

**7.8.5.3 Preset 1**
- See below 7.8.6.5

**7.8.5.4 Preset 2**
- See below 7.8.6.6

**7.8.5.5 Preset 3 and 4**
- See below 7.8.6.7

**7.8.6 Timer**

**7.8.6.1 Main menu for Signal and Control inputs**
- Main menu for programming the signal and control inputs

**Input polarity**
- PNP: switching to Plus for all inputs in common
- nPN: switching to 0V for all inputs in common

**Filter for signal inputs Inp A and Inp B**
- For electronic control of the signal inputs
- For mechanical control of the signal inputs (for control with mechanical contacts)
Input mode time measurement

- **Start**: Edge to Inp A
  - **Stop**: Edge to Inp B

- **Start**: 1. Edge to Inp B
  - **Stop**: 2. Edge to Inp B

- Timing can only be controlled via the Gate input
  - Inp A and Inp B: no function

- The timer is reset by means of a RESET (to zero when adding, to preset 2 when subtracting) and then starts timing again.
- Timing is stopped with adding operations when preset 2 is reached.
- Timing is stopped with subtracting operations when zero is reached.
- A RESET during the timing process also causes this to stop.
  - Inp A and Inp B: no function

Gate control for timing

- Timing takes place when the Gate input is not active

- Timing takes place when the Gate input is active

User input

- When the MPI input is activated, the display is “frozen” and remains “frozen” until the MPI input is deactivated.
  - Internally the preset timer continues counting
- When the MPI input is activated, the current count value for the preset that has just been selected will be adopted as the new preset value. See also 7.9
- When the MPI input is activated, the preset timer will be set to the value specified in the parameter SETPt. See also 7.10

Lock input

- When the Lock input is activated, the programming is inhibited

- When the Lock input is activated, the setting of the preset values is inhibited

- When the Lock input is activated, the setting of the preset values and the programming are both inhibited

7.8.6.2 Main menu for output operations

- **Count mode ADD**
  - Outputs active when count status ≥ preset value
  - Reset to zero

- **Count mode SUBTRACT**
  - Outputs 1, 3 and 4 active when count status ≤ preset values 1, 3 and 4
  - Output 2 active when count status ≤ 0
  - Reset to preset value 2

- **Count mode ADDING with automatic reset**
  - Outputs 1, 3 and 4 active when count status ≥ preset values 1, 3 and 4
  - Output 2 (timed signal) active when count status = preset value 2
  - Automatic reset to zero when count status = preset value 2
  - Reset to preset value 2

- **Count mode SUBTRACTING with automatic reset**
  - Outputs 1, 3 and 4 active when count status ≤ preset values 1, 3 and 4
  - Output 2 (timed signal) active when count status = 0
  - Automatic reset to preset value 2 when count status = 0
  - Reset to preset value 2

- **Count mode ADDING with automatic reset and Batch counter**
  - Output 2 (timed signal) active when main counter = preset value 2
  - Automatic reset to zero when main counter = preset value 2
  - Output 3 active when main counter ≥ preset value 3
  - Batch counter counts the number of automatic repetitions of preset 2
  - Output 1 resp. 4 active when batch counter ≥ preset 1 resp. 4
  - Manual reset sets both counters to zero
  - Electrical reset sets only main counter to zero
Count mode ADDING with automatic reset and Total counter
Output 2 (timed signal) active when main counter = preset value 2
Automatic reset to zero when main counter = preset value 2
Output 3 active when main counter ≥ preset value 3
Total counter counts all the count pulses from the main counter
Output 1 resp. 4 active when total counter ≥ preset value 1 resp. 4
Manual Reset sets both counters to zero
Electronic reset only sets the main counter to zero

7.8.6.3 Main menu for configuration
Main menu for matching the time ranges and display
Unit of time
Unit of time: seconds
Decimal point setting determines the resolution
Unit of time: minutes
Decimal point setting determines the resolution
Unit of time: hours
Decimal point setting determines the resolution
Unit of time: hrs. min. sec.
Decimal point setting (Resolution)
Decimal place (determines the resolution)
0 no decimal place
0.0 1 decimal place
0.00 2 decimal places
0.000 3 decimal places
Set value
Set value can be programmed from 000000 to 999999.
A previously programmed decimal point will be displayed
Display color (for device E5-648-C446x)
Display color
Upper line: red
Lower line: red
Display color
Upper line: red
Lower line: green

7.8.6.4 Main menu for reset mode
Setting the reset mode
Manual reset (with red key)
and electrical reset (reset input)
No reset possible
(red key and reset input inhibited)
Only electrical reset possible (reset input)
Only manual reset possible (red key)

7.8.6.5 Main menu for preset 1
Main menu for turning preset 1 ON/OFF
ADD mode output operations:
permanent signal at output 1,
becomes active when count ≥ preset 1
SUB mode output operations:
permanent signal at output 1,
becomes active when count ≤ preset 1
ADD mode output operations:
permanent signal at output 1,
becomes passive when count ≥ preset 1
SUB mode output operations:
permanent signal at output 1,
becomes passive when count ≤ preset 1
ADD mode output operations:
timed signal at output 1,
becomes active when count ≥ preset 1.
(Activation only in positive direction)
SUB mode output operations:
timed output at output 1,
becomes active when count ≤ preset 1.
(Activation only in negative direction)
ADD mode output operations:
timed signal at output 1,
becomes passive when count ≥ preset 1.
(Deactivation only in positive direction)
SUB mode output operations:
timed output at output 1,
becomes passive when count ≤ preset 1.
(Deactivation only in negative direction)
ADD mode output operations: timed signal at output 1, becomes active with positive direction and when count ≥ preset 1 and subsequently active with negative direction and when count ≤ preset 1.

SUB mode output operations: timed signal at output 1, becomes active with negative direction and when count ≤ preset 1 and subsequently active with positive direction and when count ≥ preset 1.

Duration of timed signal of output 1, programmable from 00.01 to 99.99s.

Timed signal is post-triggered.

7.8.6.6 Main menu for preset 2

ADD mode output operations: permanent signal at output 2, becomes active when count ≥ preset 2.

SUB mode output operations: permanent signal at output 2, becomes active when count ≤ zero.

ADD mode output operations: permanent signal at output 2, becomes passive when count ≥ preset 2.

SUB mode output operations: permanent signal at output 2, becomes passive when count ≤ zero.

ADD mode output operations: timed signal at output 2, becomes active when count ≥ preset 2 (Activation only in positive direction).

SUB mode output operations: permanent signal at output 2, becomes active when count ≤ zero (Activation only in negative direction).

ADD mode output operations: timed signal at output 2, becomes active when count ≥ preset 2 (Deactivation only in positive direction).

SUB mode output operations: permanent signal at output 2, becomes passive when count ≤ zero (Deactivation only in negative direction).

7.8.6.7 Main menu for preset 3 and 4

Only preset 3 is represented here.

Main menu for preset 3 [4]

ADD mode output operations: permanent signal at output 3 [4], becomes active when count ≥ preset 3 [4].

SUB mode output operations: permanent signal at output 3 [4], becomes active when count ≤ preset 3 [4].

ADD mode output operations: permanent signal at output 3 [4], becomes passive when count ≥ preset 3 [4].

SUB mode output operations: permanent signal at output 3 [4], becomes passive when count ≤ preset 3 [4].

ADD mode output operations: timed signal at output 3 [4], becomes active when count ≥ preset 3 [4]. (Activation only in positive direction)

SUB mode output operations: timed signal at output 3 [4], becomes active when count ≤ preset 3 [4]. (Activation only in negative direction)

ADD mode output operations: timed signal at output 3 [4], becomes passive when count ≥ preset 3 [4]. (Deactivation only in positive direction)

SUB mode output operations: timed signal at output 3 [4], becomes passive when count ≤ preset 3 [4]. (Deactivation only in negative direction)
ADD mode output operations:
timed signal at output 3 [4],
becomes active with positive direction and when count ≥ preset 3 [4] and subsequently active with negative direction and when count ≤ preset 3 [4]

SUB mode output operations:
timed signal at output 3 [4],
becomes active with negative direction and when count ≤ preset 3 [4] and subsequently active with positive direction and when count ≥ preset 3 [4]

ADD mode output operations:
timed signal at output 3 [4], becomes passive with positive direction and when count ≥ preset 3 [4] and subsequently passive with negative direction and when count ≤ preset 3 [4]

SUB mode output operations:
timed signal at output 3 [4], becomes passive with negative direction and when count ≤ preset 3 [4] and subsequently passive with positive direction and when count ≥ preset 3 [4]

Duration of timed signal of output 3 [4], programmable from 00.01 to 99.99 s
Timed output is post-triggered

7.9 Setting the presets
7.9.1 Setting via decade keys
In operating mode preset 4 will be displayed in the lower line, excepted for the output operations AddBat and AddTot.

Press the Prog/Mode key until the preset to be changed is displayed—PRT, PR2, PR3 or PR4

Press any decade key
Display switches to the editor mode

Set the desired preset value using the decade keys

Press the Prog/Mode key to confirm the value and save it
Display switches to the editor mode of the next preset PR2 or PR4

Approx. 3s after the last press of the decade keys, or by pressing the Reset key, the new preset value will be accepted and the counter will switch back to operating mode

7.9.2 Setting with Teach-In function
Program the MPI input to tEAc

In programming mode, select the preset to be changed using the Prog/Mode key

Briefly activate the MPI (NPN or PNP input logic)
- The current count value will be adopted as the new preset value
- The preset value can subsequently be further modified via the decade keypad

7.10 Set function
Both the pulse counter and the timer can be set to a default value by means of the Set function.

Program the MPI input to SET

Set menu item SETPt to the desired value

Briefly activate the MPI (NPN or PNP input logic)
- In Adding modes: the pulse counter or timer will be set to the SETPt value
- In Subtracting modes: the pulse counter or timer will be set to a value that is the sum of Preset 2 value and the value of SETPt

8. Error message

<table>
<thead>
<tr>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Er 1</td>
<td>Set value is outside the permitted range</td>
</tr>
</tbody>
</table>
9. Connections

![Figure 1. Connections](image)

9.1 Signal and control inputs

<table>
<thead>
<tr>
<th>Number</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC: 24 Vdc/80 mA DC: UB connected through</td>
<td>Sensor supply voltage</td>
</tr>
<tr>
<td>2</td>
<td>GND (0 Vdc)</td>
<td>Common connection signal and control inputs</td>
</tr>
<tr>
<td>3</td>
<td>INP A</td>
<td>Signal input A</td>
</tr>
<tr>
<td>4</td>
<td>INP B</td>
<td>Signal input B</td>
</tr>
<tr>
<td>5</td>
<td>RESET</td>
<td>Reset input</td>
</tr>
<tr>
<td>6</td>
<td>LOCK</td>
<td>Keypad lock</td>
</tr>
<tr>
<td>7</td>
<td>GATE</td>
<td>Gate input</td>
</tr>
<tr>
<td>8</td>
<td>MPI</td>
<td>User input</td>
</tr>
</tbody>
</table>

9.2 Supply voltage and outputs

<table>
<thead>
<tr>
<th>Number</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Relay contact C.1</td>
<td>Output 1</td>
</tr>
<tr>
<td>10</td>
<td>Relay contact N.O.1</td>
<td>Output 1</td>
</tr>
<tr>
<td>11</td>
<td>Relay contact C.2</td>
<td>Output 2</td>
</tr>
<tr>
<td>12</td>
<td>Relay contact N.O.2</td>
<td>Output 2</td>
</tr>
<tr>
<td>13</td>
<td>Relay contact N.C.2</td>
<td>Supply voltage</td>
</tr>
<tr>
<td>15</td>
<td>AC: 90–260 Vac L–DC: GND (0 Vdc)</td>
<td>Supply voltage</td>
</tr>
<tr>
<td>16</td>
<td>Relay contact N.C.4</td>
<td>Output 4</td>
</tr>
<tr>
<td>17</td>
<td>Relay contact C.4</td>
<td>Output 4</td>
</tr>
<tr>
<td>18</td>
<td>Relay contact N.O.4</td>
<td>Output 4</td>
</tr>
<tr>
<td>19</td>
<td>Relay contact N.O.3</td>
<td>Output 3</td>
</tr>
<tr>
<td>20</td>
<td>Relay contact C.3</td>
<td>Output 3</td>
</tr>
</tbody>
</table>

10. Technical data

10.1 General data

- Display: LCD positive or negative, backlit 2 x 6-digit
- Digit height
  - Upper line: 9 mm
  - Lower line: 7 mm
  - Special characters: 2 mm
- Overload: Blinking, 1s
- Underload: Counter loses up to 1 decade no pulses
- Data retention: >10 years, EEPROM
- Operation: 8 keys

10.2 Pulse counter

- Count frequency: max. 50 kHz (see section 13, Frequencies)
- Response time of the outputs—Relays
  - Add/Sub: <16 ms
  - With automatic repeat: <13 ms
  - A/B; (A-B)/A: <38 ms

10.3 Tacho/frequency meter

- Frequency range: 0.01 Hz to 50 kHz (see section 13, Frequencies)
- Measuring principle
  - ≤76.3 Hz Time interval (period measurement)
  - >76.3 Hz Gate time
  - Gate time approx. 13.1 ms
- Measuring error: <0.1% per channel
- Response time of the outputs
  - 1-channel operation: <110 ms at 40 kHz, <170 ms at 50 kHz
  - 2-channel operation: <200 ms at 40 kHz, <300 ms at 50 kHz

10.4 Timer

- Seconds: 0.001s–999 999s
- Minutes: 0.001 min–999 999 min
- Hours: 0.001h–999 999h
- h.min.s: 00h.00min.01s–99h.59min.59s
- Min. time measurable: 500 µs
- Measuring error: <50 ppm
- Response time of the outputs:
  - Relays: <16 ms
10.5 Signal and control inputs
- Polarity: programmable NPN/PNP for all inputs in common
- Input resistance: 5 kohms
- Pulse shape: any
- Switching level with AC supply:
  - HTL level: Low: 0–4 Vdc; High: 12–30 Vdc
  - 5V level: Low: 0–2 Vdc; High: 3.5–30 Vdc
- Switching level with DC supply:
  - HTL level: Low: 0–0.2 x UB; High: 0.6 x UB–30 Vdc
  - 5V level: Low: 0–2 Vdc; High: 3.5–30 Vdc
- Minimum pulse length of the Reset input: 1 ms
- Minimum pulse length of the Control inputs: 10 ms

10.6 Outputs

Output 1
- Relay with make contact programmable as NC or NO
- Switching voltage: max. 250 Vac/110 Vdc
- Switching current: max. 3 A AC/12 Vdc, min. 30 mA DC
- Switching capacity: max. 750 VA/90W
- Mechanical service life (switching cycles): 2 x 10^7
- Number of switching cycles at 3A/250 Vac: 1 x 10^6
- Number of switching cycles at 3A/30 Vdc: 1 x 10^6

Output 2
- Relay with changeover contact
- Switching voltage: max. 250 Vac/150 Vdc
- Switching current: max. 3 A AC/12 Vdc, min. 30 mA DC
- Switching capacity: max. 750 VA/90W
- Mechanical service life (switching cycles): 20 x 10^6
- Number of switching cycles at 3A/250 Vac: 5 x 10^4
- Number of switching cycles at 3A/30 Vdc: 5 x 10^4

Output 3
- Relay with make contact
- Switching voltage: max. 125 Vac/110 Vdc
- Switching current: max. 1 A AC/12 Vdc, min. 1 mA AC/DC
- Switching capacity: max. 62.5 VA/30W
- Mechanical service life (switching cycles): 5 x 10^7
- Number of switching cycles at 0.5A/125 Vac: 1 x 10^5
- Number of switching cycles at 1A/30 Vdc: 1 x 10^5

Output 4
- Relay with changeover contact
- Switching voltage: max. 125 Vac/110 Vdc
- Switching current: max. 1 A AC/12 Vdc, min. 1 mA AC/DC
- Switching capacity: max. 62.5 VA/30W
- Mechanical service life (switching cycles): 5 x 10^7
- Number of switching cycles at 0.5A/125 Vac: 1 x 10^5
- Number of switching cycles at 1A/30 Vdc: 1 x 10^5

10.7 Supply voltage
- AC supply
  - 90–260 Vac/max. 8 VA 50/60 Hz
  - Ext. fuse protection: T 0.1A
- DC supply
  - 10–30 Vdc/max. 1.5W reverse polarity protection
  - Ext. fuse protection T 0.2A

10.8 Sensor supply voltage
- AC supply: 24 Vdc ±15%, 80 mA
- DC supply: max. 80 mA, external voltage supply is connected through

10.9 Climatic conditions
- Operating temperature: –20°C to 65°C
- Storage temperature: –25°C to 75°C
- Relative humidity: RH. 93% at 40°C, non-condensing
- Altitude: to 2000m

10.10 EMC
- Noise immunity: EN61000-6-2 with shielded signal and control cables
- Noise emission: EN55011 Class B

10.11 Device safety
- Design to: EN61010 Part 1
- Protection class: Class 2
- Application area: Soiling Level 2

10.12 Mechanical data
- Housing: Panel-mount housing to DIN 43 700, RAL 7021
- Dimensions: 48 x 48 x 91 mm
- Panel cut-out: 45+0.6 x 45+0.6 mm
- Installation depth: ca. 107 mm incl. terminals
- Weight: ca. 125g
- Protection: IP 65 (front)
- Housing material: Polycarbonate UL94 V-2
- Vibration resistance: 10–55 Hz/1 mm/XYZ (EN60068-2-6): 30 min in each direction
- Shock resistance: 100G/XYZ (EN60068-2-27): 3 times in each direction
- Cleaning: The front of the unit should only be cleaned using a soft damp (water) cloth

10.13 Connections
- Supply voltage and outputs
  - Plug-in screw terminal: 7-pin, RM 5.08
  - Core cross section: max. 2.5 mm²
  - Plug-in screw terminal: 5-pin, RM 3.81
  - Core cross-section: max. 1.5 mm²
- Signal and control inputs:
  - Plug-in screw terminal: 8-pin, RM 3.81
  - Core cross-section: max. 1.5 mm²
11. **Scope of delivery**
- Preset counter
- Mounting clip
- Instruction manual

12. **Ordering codes**

```
E5-648-C446_x

Supply voltage
1 = 90 to 260 Vac
2 = 10 to 20 Vdc
```

13. **Frequencies (typical)**

13.1 **Pulse counter**

**HTL level**
- AC supply
  - Typ. Low: 2.5V
  - Typ. High: 22V
- DC supply—12V
  - Typ. Low: 2V
  - Typ. High: 10V
- DC supply—24V
  - Typ. Low: 2.5V
  - Typ. High: 22V

**5V level**
- Typ. Low: 1.0V
- Typ. High: 4.0V

### Display

<table>
<thead>
<tr>
<th>Display</th>
<th>Add</th>
<th>Sub</th>
<th>AddAr</th>
<th>SubAr</th>
<th>AddTot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cnt.Dir</td>
<td>55 kHz</td>
<td></td>
<td>1.5 kHz</td>
<td></td>
<td>1.6 kHz</td>
</tr>
<tr>
<td>Up.Dn</td>
<td>20 kHz</td>
<td></td>
<td>1.5 kHz</td>
<td></td>
<td>1.6 kHz</td>
</tr>
<tr>
<td>Up</td>
<td></td>
<td></td>
<td>0.7 kHz</td>
<td></td>
<td>0.7 kHz</td>
</tr>
<tr>
<td>Quad</td>
<td>28 kHz</td>
<td></td>
<td></td>
<td>0.7 kHz</td>
<td></td>
</tr>
<tr>
<td>Quad 2</td>
<td></td>
<td></td>
<td></td>
<td>0.7 kHz</td>
<td></td>
</tr>
<tr>
<td>Quad 4</td>
<td>10 kHz</td>
<td></td>
<td>0.7 kHz</td>
<td></td>
<td>0.7 kHz</td>
</tr>
<tr>
<td>A/B</td>
<td>29 kHz</td>
<td></td>
<td>29 kHz</td>
<td>29 kHz</td>
<td></td>
</tr>
<tr>
<td>(A-B)/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13.2 **Frequency meter**

**HTL level**
- AC supply
  - Typ. Low: 2.5V
  - Typ. High: 22V
- DC supply—12V
  - Typ. Low: 2V
  - Typ. High: 10V
- DC supply—24V
  - Typ. Low: 2.5V
  - Typ. High: 22V

**5V level**
- Typ. Low: 1.0V
- Typ. High: 4.0V

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>HTL</th>
<th>5V</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>65 kHz</td>
<td>9 kHz</td>
</tr>
<tr>
<td>A – B</td>
<td>59 kHz</td>
<td>9 kHz</td>
</tr>
<tr>
<td>A + B</td>
<td>30 kHz</td>
<td>9 kHz</td>
</tr>
</tbody>
</table>

**Switching levels of the input**

**Switching levels with AC supply:**
- HTL level
  - Low: 0–4 Vdc
  - High: 12–30 Vdc
- 5V level
  - Low: 0–2 Vdc
  - High: 3.5–30 Vdc

**Switching levels with DC supply:**
- HTL level
  - Low: 0–0.2 x UB
  - High: 0.6 x UB–30 Vdc
- 5V level
  - Low: 0–2 Vdc
  - High: 3.5–30 Vdc
14. Input modes: Pulse counting

<table>
<thead>
<tr>
<th>Function</th>
<th>Diagram</th>
<th>P = Preset</th>
<th>PNP: Count on Rising Edge</th>
<th>NPN: Count on Falling Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cnt.Dir</td>
<td>INP A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INP B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADD</td>
<td>0 1 2 1 0</td>
<td>-1 -2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB</td>
<td>P P' +1 P +2</td>
<td>P' +1 P P' -1 P' -2</td>
<td></td>
</tr>
<tr>
<td>Up.Dn</td>
<td>INP A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INP B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADD</td>
<td>0 1 2 1 0</td>
<td>0 0 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB</td>
<td>P P' +1 P +2</td>
<td>P' +1 P P' +1</td>
<td></td>
</tr>
<tr>
<td>Up.Up</td>
<td>INP A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INP B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADD</td>
<td>0 1 2 3 4 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad</td>
<td>INP A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INP B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADD</td>
<td>0 1 2 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB</td>
<td>P P' +1 P +2 P' +3 P +2 P' +3 P +1 P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad 2</td>
<td>INP A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INP B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADD</td>
<td>0 1 2 3 4 3 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB</td>
<td>P P' +1 P +2 P' +3 P +4 P' +3 P' +2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

① No counting when GATE input is active
### 14. Input modes: Pulse counting, continued

<table>
<thead>
<tr>
<th>Function</th>
<th>Diagram</th>
<th>P = Preset</th>
<th>PNP: Count on rising edge</th>
<th>NPN: Count on falling edge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quad 4</strong></td>
<td><img src="image" alt="Diagram" /></td>
<td></td>
<td>A 90° B</td>
<td></td>
</tr>
<tr>
<td>INP A</td>
<td><img src="image" alt="Diagram" /></td>
<td>0 1 2 3 4 5 6 7</td>
<td>Inp A: Count input</td>
<td></td>
</tr>
<tr>
<td>INP B</td>
<td><img src="image" alt="Diagram" /></td>
<td>0 1 2 3 4 5 6 7</td>
<td>Inp B: Count input</td>
<td>Count on rising and on falling edges, Reverse direction</td>
</tr>
<tr>
<td>ADD</td>
<td><img src="image" alt="Diagram" /></td>
<td>P+1 P+2 P+3 P+4 P+5 P+6 P+7</td>
<td>Add: Display 0 -&gt; Preset</td>
<td></td>
</tr>
<tr>
<td>SUB</td>
<td><img src="image" alt="Diagram" /></td>
<td>P+1 P+2 P+3 P+4 P+5 P+6 P+7</td>
<td>Sub: Display Preset -&gt; 0</td>
<td></td>
</tr>
</tbody>
</table>

#### A/B

| INP A | ![Diagram](image) | Counts A | 0 1 1 1 2 3 4 | Inp A: Count input 1 | Inp B: Count input 2 |
| Counts B | ![Diagram](image) | | 0 1 2 3 3 4 4 | Formula: A/B | |
| Display | ![Diagram](image) | | 0 1 0.5 0.33 0.66 0.75 1 | | |

#### [A-B]/A

| INP A | ![Diagram](image) | Counts A | 0 1 1 1 2 3 4 | Inp A: Count input 1 | Inp B: Count input 2 |
| Counts B | ![Diagram](image) | | 0 1 2 3 3 4 4 | Formula: (A – B)/A x100 | |
| Display | ![Diagram](image) | | 0% 1% -100% -200% -50% -33% 0% | | |

① Note: No counting when GATE input is active
15. Input modes: Timing

<table>
<thead>
<tr>
<th>Function</th>
<th>Diagram</th>
<th>PNP: Count on rising edge</th>
<th>NPN: Count on falling edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>InA, InB</td>
<td><img src="image" alt="Diagram" /></td>
<td>Inp A: Start&lt;br&gt;Imp B: Stop&lt;br&gt;Add: Display 0 → Preset&lt;br&gt;Sub: Display Preset → 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inp A: Start&lt;br&gt;Inp B: Stop&lt;br&gt;Add: Display 0 → Preset&lt;br&gt;Sub: Display Preset → 0</td>
<td></td>
</tr>
<tr>
<td>FrRun</td>
<td><img src="image" alt="Diagram" /></td>
<td>Inp A: no function&lt;br&gt;Inp B: no function&lt;br&gt;Control of the timing only via the GATE input&lt;br&gt;Add: Display 0 → Preset&lt;br&gt;Sub: Display Preset → 0</td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td><img src="image" alt="Diagram" /></td>
<td>Inp A: no function&lt;br&gt;Inp B: no function&lt;br&gt;Control of the timing via RESET (manual or electrical)&lt;br&gt;Add: Display 0 → Preset&lt;br&gt;Sub: Display Preset → 0</td>
<td></td>
</tr>
</tbody>
</table>
### 16. Input modes: Frequency meter

<table>
<thead>
<tr>
<th>Function</th>
<th>Diagram</th>
<th>PNP: Count on rising edge</th>
<th>NPN: Count on falling edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><img src="image" alt="Diagram A" /></td>
<td>Inp A: Frequency input</td>
<td>Inp B: no function</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram A" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram A" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram A" /></td>
<td>Inp A: Frequency input 1</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td>AsubB</td>
<td><img src="image" alt="Diagram AsubB" /></td>
<td>Inp A: Frequency input 1</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram AsubB" /></td>
<td>Formula:</td>
<td>A – B</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram AsubB" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AaddB</td>
<td><img src="image" alt="Diagram AaddB" /></td>
<td>Inp A: Frequency input 1</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram AaddB" /></td>
<td>Formula:</td>
<td>A + B</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram AaddB" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad</td>
<td><img src="image" alt="Diagram Quad" /></td>
<td>A 90° B</td>
<td>Inp A: Frequency input 1</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram Quad" /></td>
<td>Inp B: Reverse direction</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram Quad" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A/B</td>
<td><img src="image" alt="Diagram A/B" /></td>
<td>Inp A: Frequency input 1</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram A/B" /></td>
<td>Formula:</td>
<td>A/B</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram A/B" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A-B)/A</td>
<td><img src="image" alt="Diagram (A-B)/A" /></td>
<td>Inp A: Frequency input 1</td>
<td>Inp B: Frequency input 2</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram (A-B)/A" /></td>
<td>Formula:</td>
<td>(A – B)/(A x 100)</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram (A-B)/A" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Function Key:**
- **A**: Input modes: Frequency meter
- **AsubB**: Subtraction
- **AaddB**: Addition
- **Quad**: Quadrature
- **A/B**: Ratio
- **(A-B)/A**: Difference

**Input Modes:**
- **0**: No input
- **FA0**: Frequency input 1
- **FA1**: Frequency input 2
- **FA2**: Frequency input 3
- **FB0**: Frequency input 4
- **FB1**: Frequency input 5
- **FB2**: Frequency input 6
- **FB3**: Frequency input 7
- **FB4**: Frequency input 8
- **FB5**: Frequency input 9
- **FB6**: Frequency input 10
- **FB7**: Frequency input 11
- **FB8**: Frequency input 12
- **FB9**: Frequency input 13
- **FB10**: Frequency input 14
- **FB11**: Frequency input 15
- **FB12**: Frequency input 16

**Display:**
- **INP A**: Frequency input 1
- **INP B**: Frequency input 2

**Formula Key:**
- **PnP**: Count on rising edge
- **NPN**: Count on falling edge

**Example Formulas:**
- **A – B**
- **A + B**
- **(A – B)/(A x 100)**
17. Output operations

<table>
<thead>
<tr>
<th>Mode</th>
<th>Diagram</th>
<th>Mode</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td><img src="image1" alt="Diagram" /></td>
<td>AddAr</td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>Sub</td>
<td><img src="image3" alt="Diagram" /></td>
<td>SubAr</td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>AddBat</td>
<td><img src="image5" alt="Diagram" /></td>
<td>AddTot</td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
</tbody>
</table>
18. Dimensional drawings (mm)

Figure 2. Dimensional Drawing

Figure 3. Panel Cut-Out
E5-648-C446x electronic preset counter with four presets (relays)
LCD negative, red-green backlighting

Notes:
Eaton Corporation
Electrical Sector
1111 Superior Ave
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
Eaton.com

© 2010 Eaton Corporation
All Rights Reserved
Printed in USA
Publication No. IL05407001E / Z9872
October 2010

Instruction leaflet IL05407001E
Effective October 2010

E5-648-C446x electronic preset counter with four presets (relays)
LCD negative, red-green backlighting