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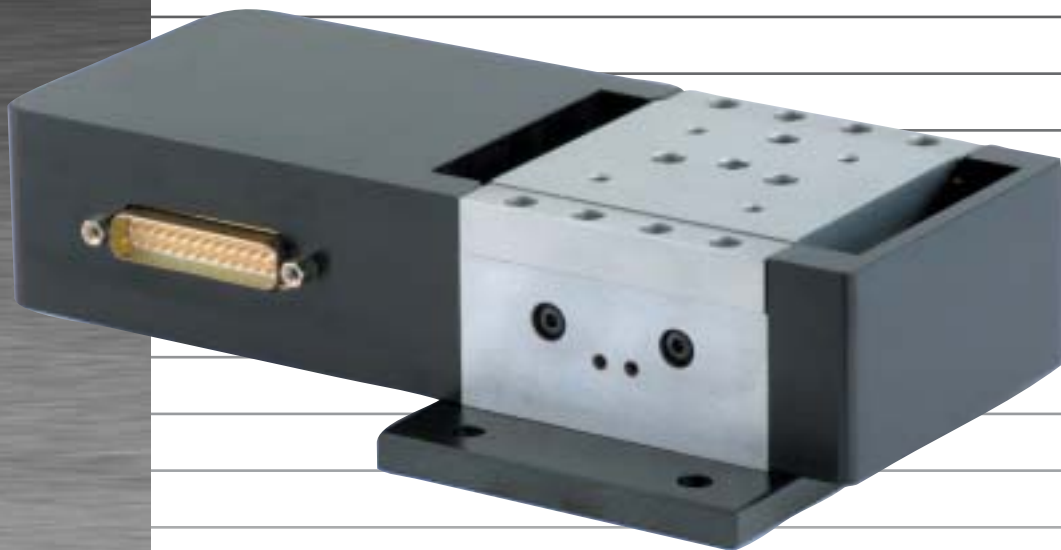
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**CTS25**

# Compact Precision Steel Linear Stage



## USER'S MANUAL

# Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's discretion.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

## Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part.

---

### CAUTION

**Warranty does not apply to damages resulting from:**

- **Incorrect usage:**
  - **Load on the stage greater than maximum specified load.**
  - **Carriage speed higher than specified speed.**
  - **Improper grounding.**
    - **Connectors must be properly secured.**
    - **When the load on the stage represents an electrical risk, it must be connected to ground.**
  - **Excessive or improper cantilever loads.**
- **Modification of the stage or any part.**

---

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

No part of this manual may be reproduced or copied without the prior written approval of Newport Corporation.

This manual has been provided for information only and product specifications are subject to change without notice. Any changes will be reflected in future printings.

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We declare that the accompanying product, identified with the “CE” mark, meets all relevant requirements of Directives:

- 73/23/EEC, for Low Voltage Compatibility.
- 89/336/EEC for Electromagnetic Compatibility.

**Generic standard:**

Emission: NF EN61326-1, for measurement, lab and control equipment.

Immunity: NF EN61326-1, for measurement, lab and control equipment.

Safety: EIC 1010-1, safety standards for measurement, lab and control equipment.

Newport Corporation shall not be liable for damages when using the product:

- Modification of the product.
- Using modified connector, or modified or not supplied cables.
- Connecting this product to non-CE equipment.

# Warnings

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## WARNING

The translation of objects of all types carries potential risks for operators. Ensure the protection of operators by prohibiting access to the dangerous area and by informing the personnel of the potential risks involved.

---

## WARNING

Do not use this stage when its motor is emitting smoke or is unusually hot to the touch or is emitting any unusual odor or noise or is in any other abnormal state.

Stop using the stage immediately, switch off the motor power and then disconnect the electronics power supply.

After checking that smoke is no longer being emitted contact your Newport service facility and request repairs. Never attempt to repair the stage yourself as this can be dangerous.

---

## WARNING

Take care that this stage is not exposed to moisture and that fluid does not get into the stage.

Nevertheless, if any fluid has entered the stage, switch off the motor power and then disconnect the electronics from power supply.

Contact your Newport service facility and request repairs.

---

## WARNING

Do not insert or drop objects into this stage, this may cause an electric shock, or lock the drive.

Do not use this stage if any foreign objects have entered the stage. Switch off the motor power and then disconnect the electronics power supply.

Contact your Newport service facility for repairs.

---

## WARNING

Do not place this stage in unstable locations such as on a wobbly table or sloping surface, where it may fall or tip over and cause injury.

If this stage has been dropped or the case has been damaged, switch off the motor power and then disconnect the electronics power supply.

Contact your Newport service facility and request repairs.

---

## WARNING

Do not attempt to modify this stage; this may cause an electric shock or downgrade its performance.

---

## WARNING

Do not exceed the usable depth indicated on the mounting holes (see section "Dimensions"). Longer screws can damage the mechanics or cause a short-circuit.

---

# Caution

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**CAUTION**

**When the carriage of a CTS25 is moving, there exists a risk of squeezing fingers in some areas of the stages. Each dangerous area is indicated by a sticker.**

---

**CAUTION**

**Do not place this stage in a hostile environment such as X-Rays, hard UV,... or in a vacuum environment less than  $10^2$  Torr.**

---

**CAUTION**

**Do not place this stage in a location affected by dust, oil fumes or steam. This may cause an electric shock.**

---

**CAUTION**

**Do not leave this stage in places subject to extremely high temperatures or low temperatures. This may cause an electric shock.**

- **Operating temperature: +10 to +35 °C.**
  - **Storage temperature: -10 to +40 °C (in its original packaging).**
- 

**CAUTION**

**Do not move this stage if its motor power is on.**

**Make sure that the cable to the electronics is disconnected before moving the stage. Failure to do so may damage the cable and cause an electrical shock.**

---

**CAUTION**

**Be careful that the stage is not bumped when it is being carried. This may cause it to malfunction.**

---

**CAUTION**

**When handling this stage, always unplug the equipment from the power source for safety.**

---

**CAUTION**

**Contact your Newport service facility to request cleaning and specification control every year.**

---

# Compact Precision Steel Linear Stage CTS25

## 1.0 Introduction

This manual provides operating instructions for the CTS25 compact precision steel linear stage.



### RECOMMENDATION

**We recommend you read carefully the chapter “Connection to electronics” before using the CTS25 translation stage.**

## 2.0 Description

The CTS25 translation stages feature steel construction with preloaded double-row linear ball bearing and a backscrew for superior performance over medium travel ranges.

The position is read on a metal optical scale with pitch of 20  $\mu\text{m}$  and a 200x interpolation of signals to obtain a 0.1  $\mu\text{m}$  resolution.

The CTS25 stage also features end-of-run limit switches at both ends of the stage to prevent bearing damage from over-travel. The origin (Mechanical Zero) is at the center of travel, with a reference on the optical scale.

Position measuring is performed with a linear encoder mounted on the stage body.

For optimal performance, we recommend the use of our MM4006 motion controllers.



The CTS25 stage is equipped with a sub-D 25-pin connector, and supplied with a cable of 3 m length for connection to our motion controllers. The male connector of this cable (stage side) has an output at 90° (see chapter 6.3)

## 3.0 Characteristics

### 3.1 Definitions

Specifications of our products are established in reference to ISO 230 standard part II “Determination of the position, precision and repeatability of the machine tools with CNC”.

This standard gives the definition of position uncertainty which depends on the 3 following quantities:

#### **(Absolute) Accuracy**

Difference between ideal position and real position.

#### **On-Axis Accuracy**

Difference between ideal position and real position after the compensation of linear error sources.

Linear errors include cosine errors, inaccuracy of screw or linear scale pitch, angular deviation at the measuring point (Abbe error) and thermal expansion effect. All Newport motion electronics can compensate for linear accuracy errors by step encoder correction.

The relation between absolute accuracy and on-axis accuracy is as follow:

$$\text{Absolute Accuracy} = \text{On-Axis Accuracy} + \text{Slope} \times \text{Travel}$$

#### **Repeatability**

Ability of a system to achieve a commanded position over many attempts.

#### **Reversal Value (Hysteresis)**

Difference between actual position values obtained for a given target position when approached from opposite directions.

#### **Minimum Incremental Motion (Sensitivity)**

Minimum motion that a stage can achieve. Our stages and our kinematic chain are conceived in such a way that sensitivity is better than the resolution of the encoder.

#### **Resolution**

The smallest motion an encoder fixed to the stage can measure.

#### **Yaw, Pitch**

Rotation of carriage around the Z axis (Yaw) or Y axis (Pitch), when it moves.

The testing of on-axis accuracy, repeatability, and reversal error are made systematically with our test equipment in an air-conditioned room (20 °C ±1 °C).

Each stage is tested with a laser interferometer.

A linear cycle with 21 measures on travel and 4 cycles in each direction gives a total of 164 points.

**3.2 Mechanical Specifications**

Travel Range	(mm)	25
Resolution	( $\mu\text{m}$ )	0.1
Bi-directional Repeatability	( $\mu\text{m}$ )	0.2
On-Axis Accuracy	( $\mu\text{m}$ )	2
Maximum Speed	(mm/s)	50
Pitch	( $\mu\text{rad}$ )	100
Yaw	( $\mu\text{rad}$ )	100
MTBF <sup>(1)</sup>	(h)	20,000

<sup>1)</sup> See chapter: "Maintenance".

**3.3 Load Specification Definitions**

**Normal Load Capacity (Cz)**

Maximum load a stage can move while maintaining specifications.

This value is given with speed and acceleration specified for each stage, and with a load perpendicular to bearings.

Specified Speed	(mm/s)	50
Specified Acceleration	(mm/s <sup>2</sup> )	200

**Axial Load Capacity ( $\pm Cx$ )**

Maximum load along the direction of the drive train.

**Off-Centered Load (Q)**

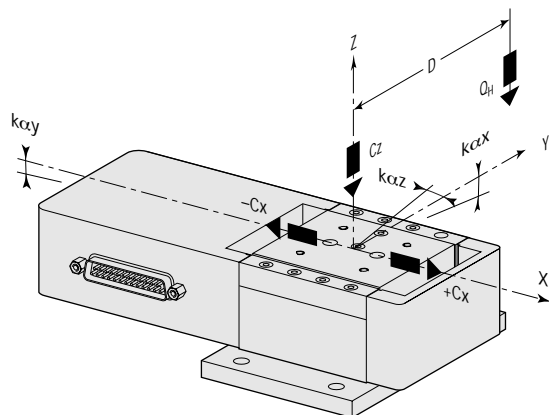
Maximum cantilever-load a stage can move:  $Q \leq Cz / (1 + D/30)$

D: Cantilever distance.

**3.4 Load Characteristics and Stiffness**

Cz	(N)	100
- Cx; + Cx	(N)	20
$k\alpha_x$	( $\mu\text{rad}/\text{N.m}$ )	50
$k\alpha_y$	( $\mu\text{rad}/\text{N.m}$ )	50
$k\alpha_z$	( $\mu\text{rad}/\text{N.m}$ )	70

**Normal Load Characteristics**



with:

- Q<sub>H</sub>: Off-center load,  $Q_H \leq Cz / (1 + D/30)$
- D: Cantilever distance in millimeters
- C<sub>Z</sub>: Normal center load capacity on bearings
- C<sub>X</sub>: Inverse load capacity on X axis
- +C<sub>X</sub>: Direct load capacity on X axis
- k $\alpha_x$ : Angular stiffness (Roll)
- k $\alpha_y$ : Angular stiffness (Pitch)
- k $\alpha_z$ : Angular stiffness (Yaw)

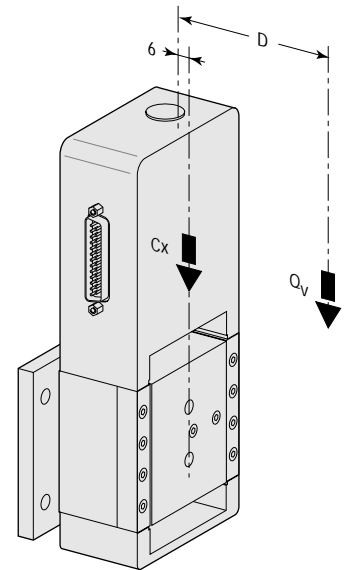
**Axial Load Characteristics**

with:

$Q_v$ : Off-center load,  
 $Q_v \leq Cz / 2 [(1 + D/30)]$   
 and  $Q_v$  must be  $\leq C_x$

$D$ : Cantilever distance in millimeters  
 between the center of mass of the  
 load and the bearings center

$6$ : Distance between top surface and  
 the bearings center in millimeters



**3.5 Stage Weight**

Weight indicated is the one for the CTS25 stage, without cable.

CTS25	(kg)	2.4
Cable	(kg)	0.3

**4.0 Drives**

The CTS25 stage is equipped with DC-motor and a linear encoder.

**Specifications**

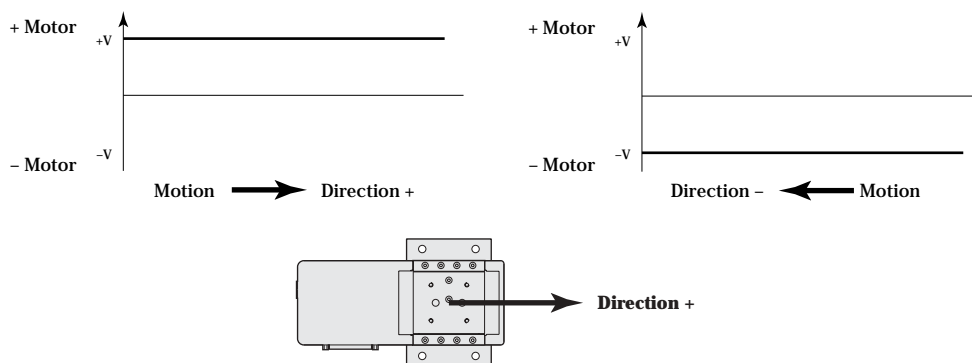
	Resolution ( $\mu\text{m}$ )	Maximum Speed (mm/s)	Motor
CTS25	0.1	50	UE35CC

**5.0 Motor**

**5.1 DC Motor Characteristics**

Motor	Nominal Voltage (V)	Nominal Current (A)	Resistance ( $\Omega$ )	Inductance (mH)
UE35CC	24	1	5.5	0.85

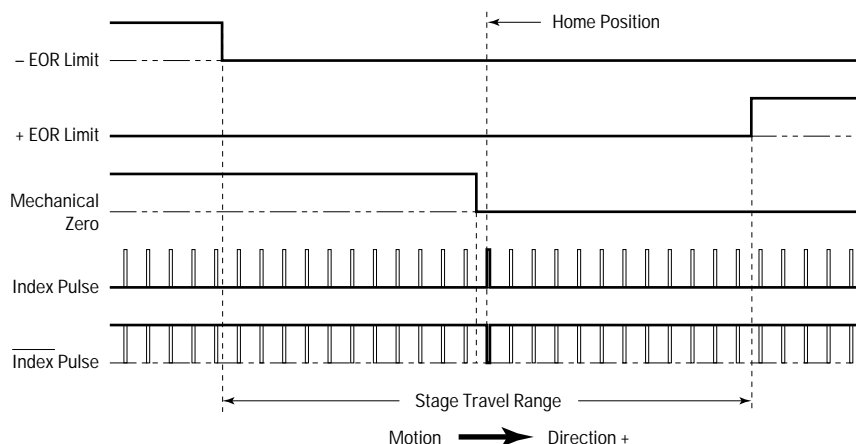
### 5.2 Command Signals for UE35CC DC Motor



In the above drawings, + Motor signal is referenced to - Motor signal.

- 1 When the stage moves in + Direction, the + Motor voltage is higher than - Motor voltage.
- 2 When the stage moves in - Direction, the + Motor voltage is lower than - Motor voltage.

### 5.3 Sensor Position



End-of-Run and Mechanical Zero are TTL type: 5 V ±5%, 2 mA max.

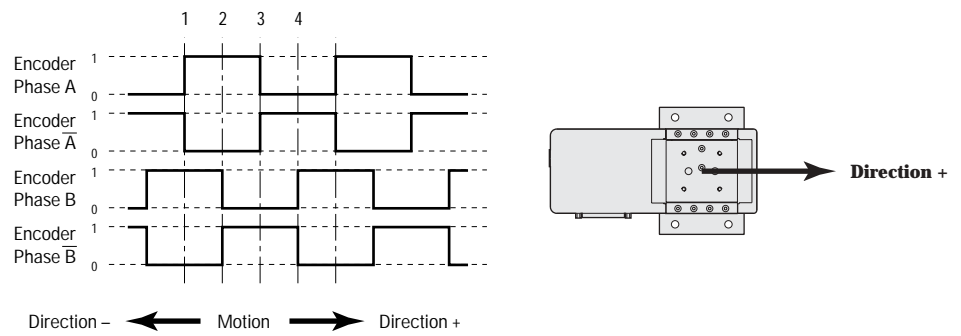
Use of the Index Pulse provides a repeatable Home Position at ±1 step.

**CAUTION**

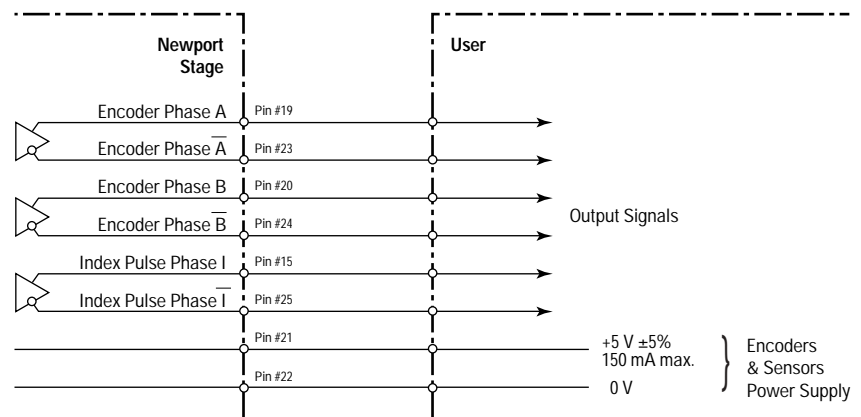
**“End-of-Run” and “Mechanical Zero” are active signals and should not be connected to any other source. Use appropriate TTL type receivers.**

Index Pulse and  $\overline{\text{Index Pulse}}$  are “differential pair” type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486.

5.4 Feedback Signal Position



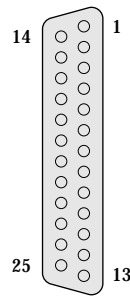
The incremental sensor consists of an optical scale and an encoder head. When the carriages of the stage move, the encoder head generates square signals in quadrature, sent to pins #19, #20, #23 and #24 of the 25-pin Sub-D connector.



Encoders are “differential pair” (type RS422) type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486 respectively.

**5.5 Pinouts**

The 25-pin Sub-D connection for the CTS25 stage is given in the following table:



UE35CC:	
<b>CTS25</b>	
<b>1</b>	N.C.
<b>2</b>	N.C.
<b>3</b>	N.C.
<b>4</b>	N.C.
<b>5</b>	+ Motor
<b>6</b>	+ Motor
<b>7</b>	- Motor
<b>8</b>	- Motor
<b>9</b>	N.C.
<b>10</b>	N.C.
<b>11</b>	N.C.
<b>12</b>	N.C.
<b>13</b>	Mechanical Zero
<b>14</b>	Shield Ground
<b>15</b>	Index Pulse I
<b>16</b>	0 V logic
<b>17</b>	+ End-of-Run
<b>18</b>	- End-of-Run
<b>19</b>	Encoder Phase A
<b>20</b>	Encoder Phase B
<b>21</b>	Encoder Power: +5 V
<b>22</b>	0 V Encoder
<b>23</b>	Encoder Phase /A
<b>24</b>	Encoder Phase /B
<b>25</b>	Index Pulse /I

## 6.0 Connection to Newport Electronics

### 6.1 Warnings on electronic units

Electronic units are intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the electronics manual carefully before operating the instrument and pay attention to all written warnings and cautions.

---

#### WARNING

**Disconnect the power plug under the following circumstances:**

- **If the power cord or any attached cables are frayed or damaged in any way.**
- **If the power plug is damaged in any way.**
- **If the unit is exposed to rain, excessive moisture, or liquids are spilled on the unit.**
- **If the unit has been dropped or the case is damaged.**
- **If you suspect service or repair is required.**
- **Whenever you clean the electronics unit.**

---

#### CAUTION

**To protect the unit from damage, be sure to:**

- **Keep all air vents free of dirt and dust.**
- **Keep all liquids away from the unit.**
- **Do not expose the unit to excessive moisture (>85% humidity).**
- **Read this manual before using the unit for the first time.**

---

#### WARNING

**All attachment plug receptacles in the vicinity of this unit are to be of the grounding type and properly polarized.**

**Contact your electrician to check your receptacles.**

---

#### WARNING

**This product is equipped with a 3-wire grounding type plug.**

**Any interruption of the grounding connection can create an electric shock hazard.**

**If you are unable to insert the plug into your wall plug receptacle, contact your electrician to perform the necessary alterations to ensure that the green (green-yellow) wire is attached to earth ground.**

---

#### WARNING

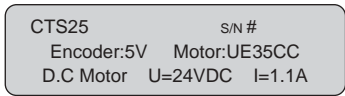
**This product operates with voltages that can be lethal.**

**Pushing objects of any kind into cabinet slots or holes, or spilling any liquid on the product, may touch hazardous voltage points or short out parts.**

---

**6.2 Connection**

On each stage is a label which indicates its name, its serial number and the motor it is equipped with (eg.: UE35CC).



**WARNING**

**Always turn power OFF on electronics units before connecting them to stage.**

Stages may be connected to the rear panel motor connectors labeled “Motor...” any time prior to power-up with the supplied cable assemblies.

**WARNING**

**With MM series controllers, damage to stage may occur if the stage is not the same type as shown on driver label located near the stage interface connector.**

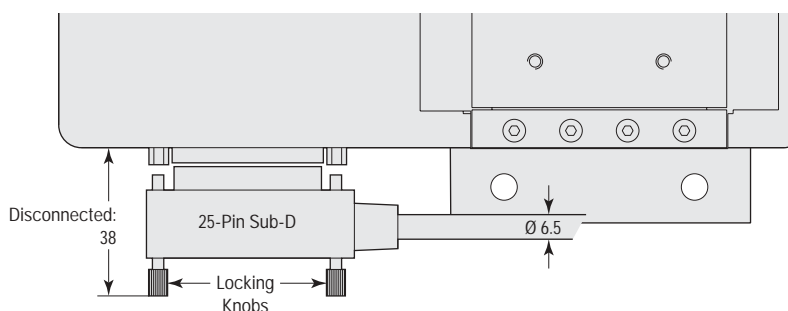
**Check the motor type (eg.: UE35CC) specified on the back side of the plugged driver module.**

**6.3 Cables**

Our CTS25 translation stage is delivered with a 3-meter cable with 25-pin Sub-D connectors. It can be directly connected to our MM4006 controller/driver.

**WARNING**

**The cable stage connector output is at 90°.**



For long distance applications, a 5-meter cable must be added (available on request) without requiring a voltage regulator.

**WARNING**

**This cable is shielded correctly. For a correct operation, make sure to lock connectors (ground continuity provided by cables).**

**WARNING**

**Keep the motor cables at a safe distance from other electrical cables in your environment to avoid potential cross talk.**



**7.0 Connection to Non-Newport Electronics**

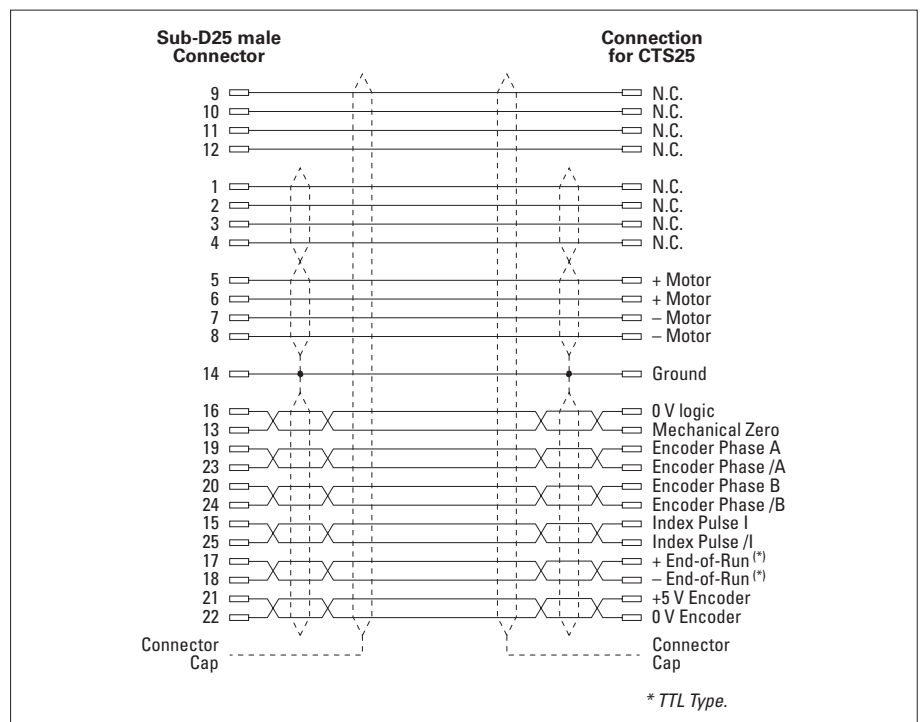
**WARNING**

Newport takes no responsibility for improper functioning or damage of a stage when it is used with any non- Newport electronics.

**WARNING**

Newport guarantees the "EC" compliance of the CTS25 translation stages only if they are used with Newport cables and electronics.

Nevertheless, the figure below indicates the recommended wiring when a CTS25 stage is used with non-Newport electronics.



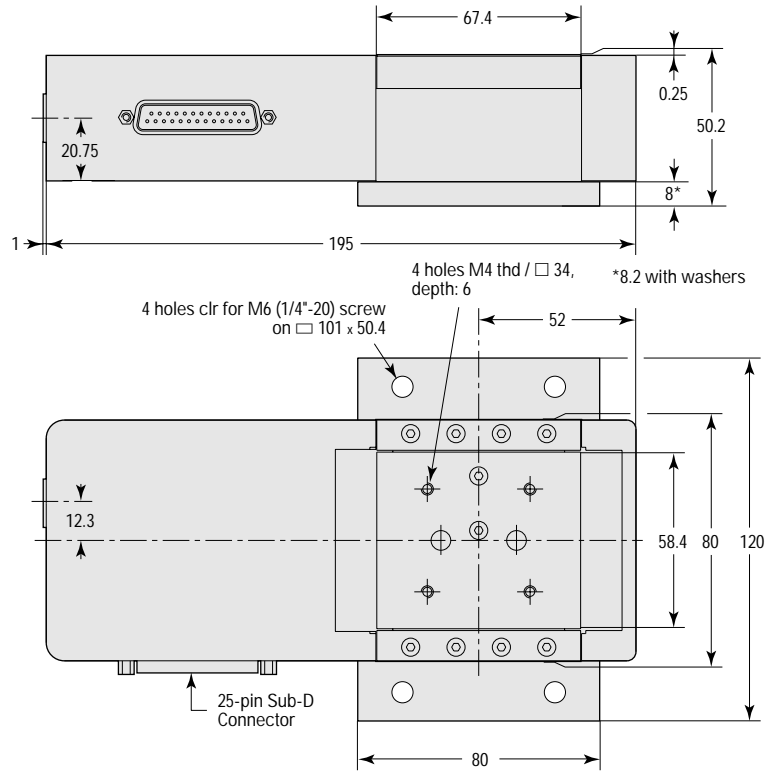
**WARNING**

**Maximum characteristics used for CE compliance:**

- **DC-motor: 25 V / 1.1 A peak to peak**

8.0 Dimensions

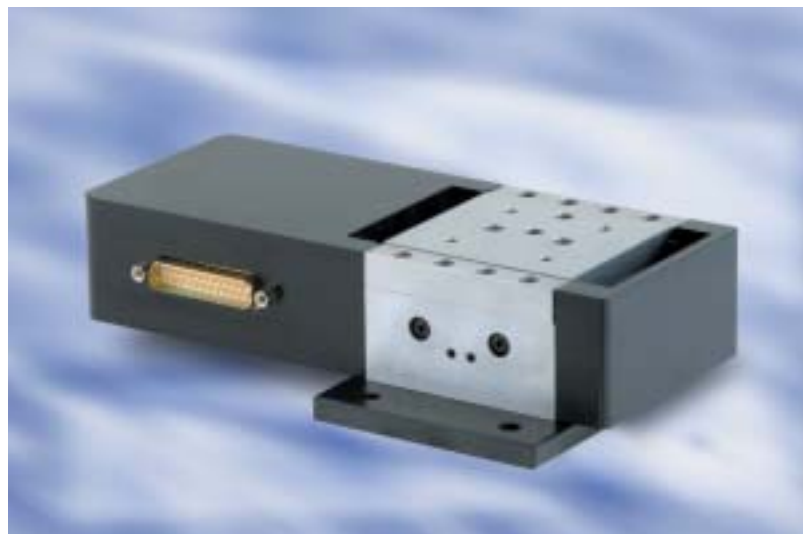
8.1 CTS25 Stage



**CAUTION**

To reach the specifications stated for CTS25, stages must be fixed on a plane surface with a flatness <math><40 \mu\text{m}</math>.

The plane surface flatness of any material fixed on the carriage of the CTS25 stage must be <math><10 \mu\text{m}</math>.



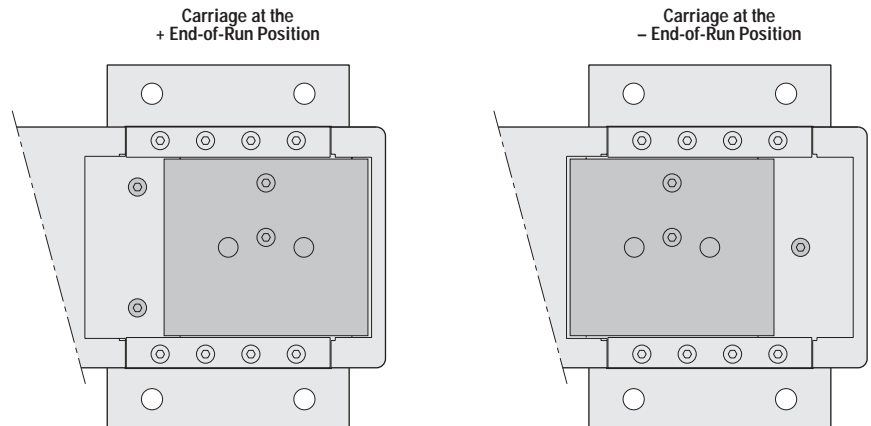
**8.2 CTS25 Stage without Base Plate**

Sometimes, it is necessary to remove the base plate of a CTS25 stage (to make an XY assembly, for example).

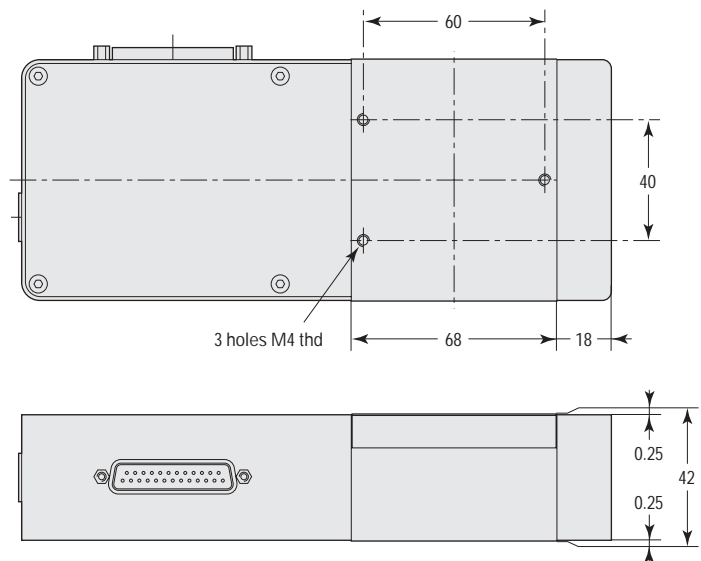
To do that, unscrew the 3 M4 x 13.5 / □ 60 x 40 captive screws of the base plate with the wrench supplied with the stage.

**CAUTION**

**To have an access to captive screws, it is necessary to move the carriage at the + End-of-Run position, then at the - End-of-Run position.**



CTS25 stage will then have the same following interfaces:

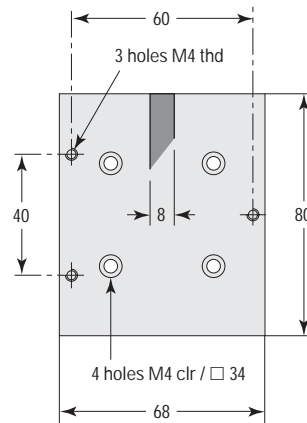


**CAUTION**

**It is imperative to re-use washers located between the body and the base plate of the CTS25 to fix the stage (without base plate) on any surface.**

**To reach the specifications stated for CTS25, stages without base plate must be fixed on a plane surface with a flatness <40 µm.**

### 8.3 CTS-IP Interface Plate

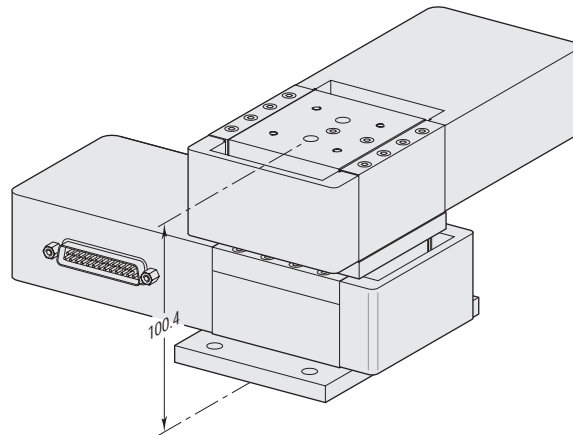


## 9.0 XY Assembly

### ATTENTION

To make an XY assembly it is necessary to remove the base plate of the upper stage, to recover washers and the 3 captive screws, and to use the optional CTS-IP interface plate.

It is imperative to re-use washers between the upper stage and the CTS-IP interface plate.



### ATTENTION

The upper stage must be fixed with recovered captive screws.

To have an access to mounting holes, it is necessary to move the CTS25 upper stage carriage at the + End-of-Run position, then at the - End-of-Run position.

---

**10.0 Maintenance**

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---

**RECOMMENDATION**

**It is recommended to contact our After Sales Service which will know to define the appropriate maintenance for your application.**

---

**10.1 Maintenance**

The CTS25 stage requires no particular maintenance. Nevertheless, this is a precision mechanical device that must be kept and manipulated with precaution.

---

**PRECAUTIONS**

**The CTS25 stage must operate, and be stocked in a clean environment, without dust, humidity, solvents or other substances.**

---

**RECOMMENDATION**

**It is recommended to return your stage to our After Sales Service after every 2000 hours of use for lubrication.**

**If your CTS25 stage is mounted on a workstation and cannot be easily dismantled, please contact our After Sales Service for further instructions.**

---

**10.2 Repairing**

---

**CAUTION**

**Never attempt to disassemble an element of the stage that has not been specified in this manual.**

**To disassemble a non specified element can cause a malfunction of the stage.**

---

If you observe a malfunction in your stage, please immediately contact us to make arrangements for a repair.

---

**CAUTION**

**All disassembly attempts or repair of stage without authorization will void your warranty.**

---

**10.3 Calibration**

---

**CAUTION**

**It is recommended to return your stage to Newport once a year for a recalibration to its original specifications.**

---



**CTS25**



**Compact Precision Newport  
Steel Linear Stage**

**EC Declaration of Conformity**

We declare that the accompanying product, identified with the “CE” mark, meets all relevant requirements of Directive:

- 73/23/CEE, for Low Voltage Compatibility.
- 89/336/EEC for Electromagnetic Compatibility.

Compliance was demonstrated to the following specifications:

**EMISSION:**

Radiated and Conducted Emission in accordance with relative prescription to the EMC, NF EN61326-1: Standards for measurement, lab and control equipment.

**IMMUNITY:**

Radiated and Conducted Emission in accordance with relative prescription to the EMC, NF EN61326-1: Standards for measurement, lab and control equipment.

**SAFETY:**

CEI 1010-1, safety standards for measurement, lab and control equipment.

Jean-Marc DELAHAYE  
Quality Director  
Zone Industrielle  
45340 Beaune-la-Rolande, France



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