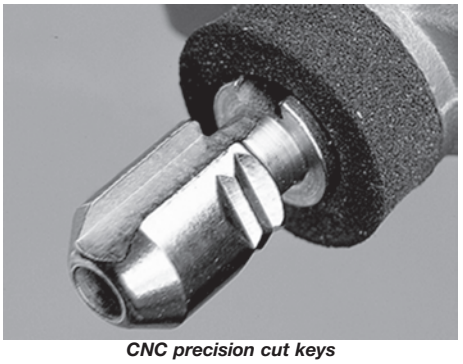
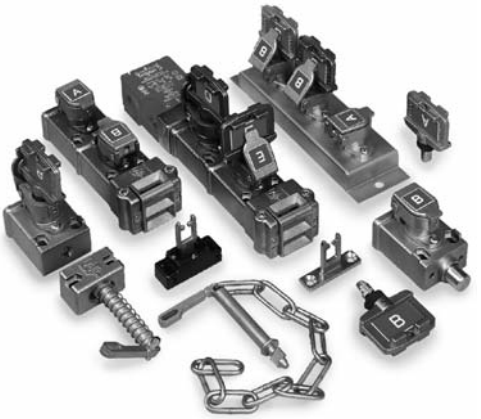
Trapped Key Switches

Overview



CNC precision cut keys



Interlocking and Control Solutions

Trapped Key Interlocks—Why Use Them?

Based upon the premise that no one key can be in two places at once, key interlock systems can be configured to provide that a predetermined sequence of events takes place or that hazards have been reduced before operators can become exposed to them.

It is a mechanical system and is therefore widely used in applications including those where the location of plant, environment or explosive atmospheres make the use of electrical interlock systems unsuitable or expensive to install. In addition, unique coding can be provided, leading to a greater degree of security and tamper-resistance.

Why Prosafe?

In order to derive the full benefits from a trapped key interlocking system its components must be totally practical, easily maintainable and readily available. Prosafe's unique key and code barrel gives the ability for even complicated interlocking systems and spare parts to be ordered from our worldwide network of distributors—fast! A first for trapped key interlocks.

Five Unique Prosafe Benefits

Compare the following to other trapped key manufacturers:

1. All stainless interlocking and coded parts—including the code barrel and internal components at no extra cost.
2. Weather cap as standard—no extra charge for dust caps and seals.
3. Standard red color-coded key and ID tags—at no extra charge.
4. Custom color/text keys and ID tags—nominal extra charge.
5. A complete range of isolators, key exchange, miniature valve interlocks and gate interlocks—all using the same key principle.

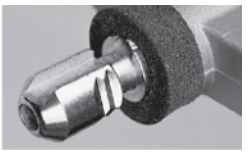
CE Marking—Tested and Approved

Only Prosafe products carry the prestigious BG mark. A sign of safety, independently tested by the German Berufsgenossen-schaftliches Institut für Arbeitssicherheit, "BIA." Additional tests for valve interlocks include Lloyds Certificate for fire test and salt-mist resistance.

Over 100,000 Operations

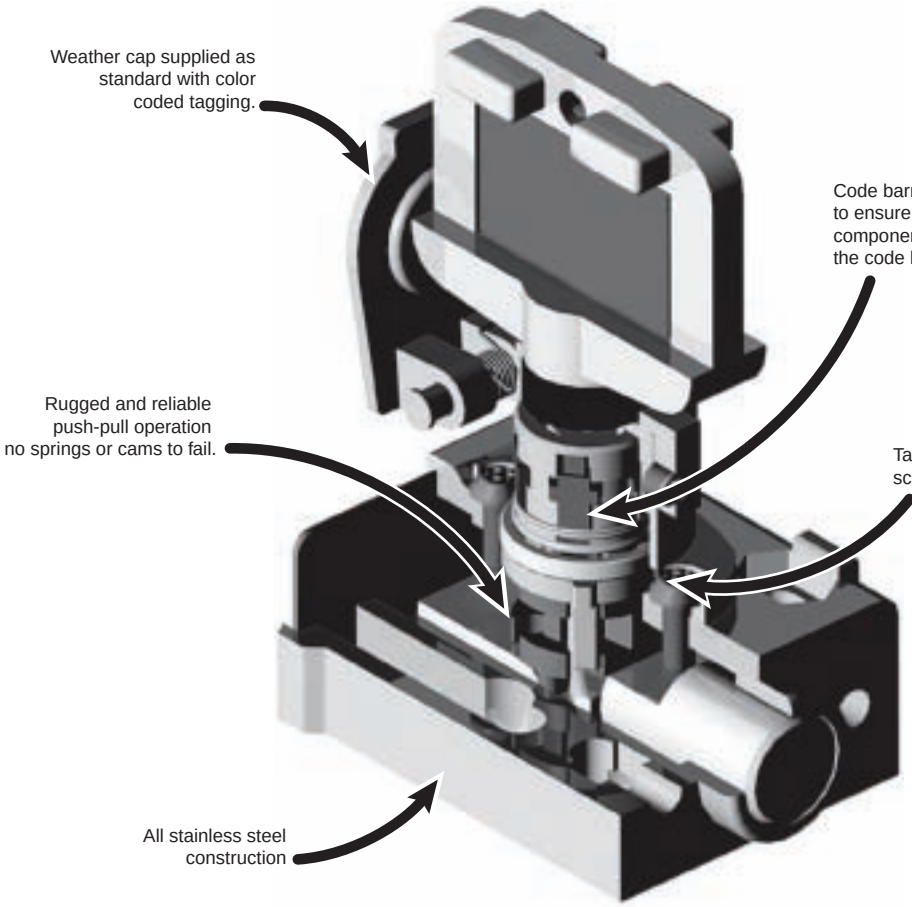
Prosafe products have been subjected to independent, exhaustive testing. With only a small amount of lubricant added infrequently, keys were inserted, rotated and removed at a rate of 12 times per minute. After 100,000 operations (at 10 operations a day this is equivalent to 27 years) the unit was functioning satisfactorily and most importantly would "pass" only the original or equivalent new key. No incorrect keys could operate the lock, underlining the unit's integrity as well as longevity.

The Prosafe Advantage



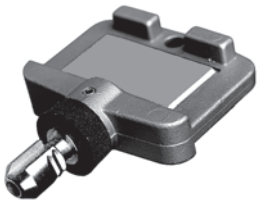
Stainless steel construction.

The Advantage



Prosafe Keys

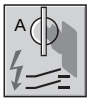
Compact, solid and sturdy keys supplied with dust seals and coded tagging. Optional colors/text are available.



Design Suggestions for an Interlocking System

Plant and Machinery Interlocking

Primary hazards
(Power isolation)



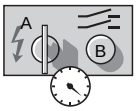
Rotary key switch

3 Port spool valve

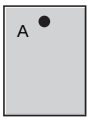
Consider removal of all power providing kinetic energy to the system i.e., electrical motors, pressurized air, etc.

Comments
Consider factors such as run down and environmental factors such as hazardous (explosive) atmospheres. Use EEX isolator and timed delay units where necessary.

Auxiliary hazards



Timed delay unit

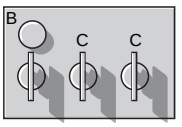


Solenoid key release unit coupled to temperature or pressure switch sensors

Bolt lock off device for grounding and capacitive discharge

Consider if the hazard is removed immediately i.e.,
a) Machine run on due to momentum.
b) Pressurization of hydraulic or pneumatic systems.
c) Stored energy such as capacitance or static electricity.
d) Temperature, either hot or cold, creating a hazard.

Key control element

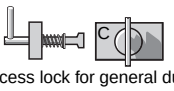


Required when more than one hazard element needs isolation or more than one exposure/access point interlocking.

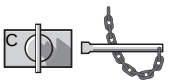
Comments
Consider sequentially interlocking all primary sources of hazard so all are eliminated. In turn, releasing a single key to input in key control element. Additional monitoring, isolation or control functions such as switches or solenoid locks may be incorporated at this stage to eliminate other elements.

Guarded area access

Bolt lock for sliding guards

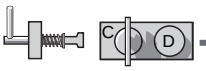


Access lock for general duty sliding, hinge and lift off guards



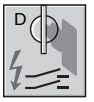
Chain interlock for large or poorly aligned sliding, hinge and lift off guards

To gain access to the danger zone.



Comments
Consider 2 key versions to provide
a) Personnel key exchange types to prevent operator lock-in (whole body access applications only).
b) Lock out devices requiring 2 keys in from different sources to enable controlled access.

Ancillary functions



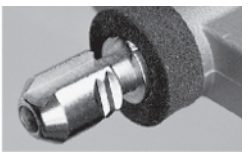
Rotary key switch

3 Port spool valve

Required when additional functions such as programming/machine resetting are necessary.

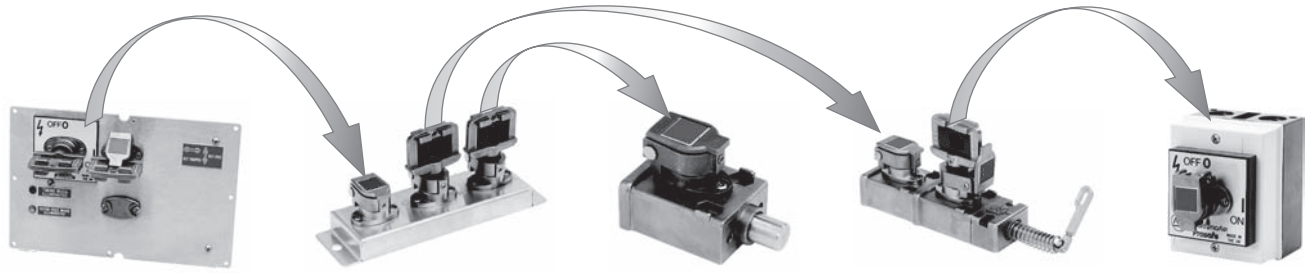
Comments
Two key versions required at access points to facilitate this feature.

The Prosafe Advantage



Stainless steel construction.

Illustrated Principles of Trapped Key Interlocking



AA
ETU
Isolator with timed delay key release

AA AB AB
KEX
Trapped key 'AA' Locking off ETU, Release access door lock, key 'AB'.

AB
SBL
'AB' key in to retract bolt from guard door.

AB AC
DAL
'AB' key in then 'AC' key out to open guard door.

AC
RKS
To energize robot teach mode.

Sequence of Operation

1. The ETU isolator has two keys. One is a nonremovable key. The other key (a "AA" coded key) can be removed after a timed duration, which is set by a potentiometer inside the ETU isolator. Turn the nonremovable key to turn the hazardous machine motion off and start the timer. When the time expires, the Key Free LED turns ON. Remove the "AA" key.
2. Insert the "AA" key into the Key Exchange Unit (KEX) and turn it 90°.
3. Turn one of the "AB" keys 90° and remove it from the KEX. This traps the "AA" key in the KEX and prevents the restarting of the machine.
4. Insert the "AB" key into the Single-key Bolt Lock (SBL) and turn it 90° to gain partial body access to the machine.
5. Turn the second "AB" key 90° and remove it from the KEX. Removal of this key also traps the "A" key in the KEX and prevents the restarting of the machine.
6. Insert the "AB" key into the Dual-key Access Lock (DAL) and turn it 90°.
7. Turn the "AC" key 90° and remove the "C" key. Rotate the access handle to allow full body entry into the hazard zone.
8. Take the "AC" key into the hazard zone, insert it into the rotary key switch (RKSE) and turn it 90° to send a signal to the machine control system, to allow the machine to operate in a slow or teach mode.
9. Reverse the process to return the machine to full operational mode.

Bill of Materials

Item	Quantity	Description	Cat. No.
1	1	Single Key Time Delayed with an AA Primary Key	**440T-MSTUE11AA**
2	1	Key Exchange Unit, AB Primary Key, Two B Secondary Keys Trapped (included)	**440T-MKEXE11AAABAB**
3	1	Single Bolt Lock, AB Primary Key	**440T-MSBLE10AB**
4	1	Dual Access Lock, AB Primary Key, C Secondary Key Trapped (included)	**440T-MDALE10ABAC**
5	1	Rotary Key Switch, AC Primary Code Barrel	**440T-MRKSE10AC**
6	1	AA Key	**440T-AKEYE10AA**

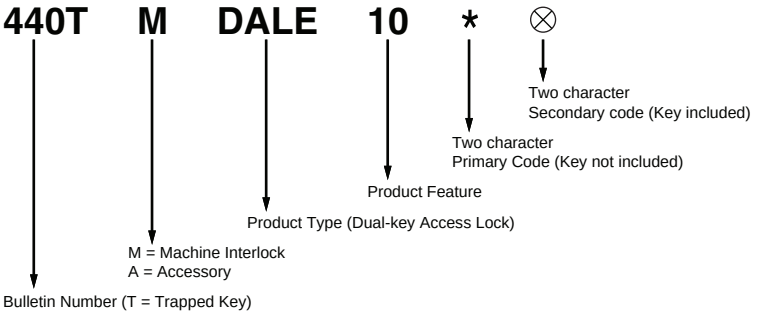
Note: Primary keys must be ordered separately, when not provided for by a previous sequential trapped key. In the example above, only one primary key must be ordered separately. The remaining primary keys are provided by a previous sequential secondary (trapped) key.

Code Selection

Ordering Prosafe trapped key products requires codes to be included in the cat. no.

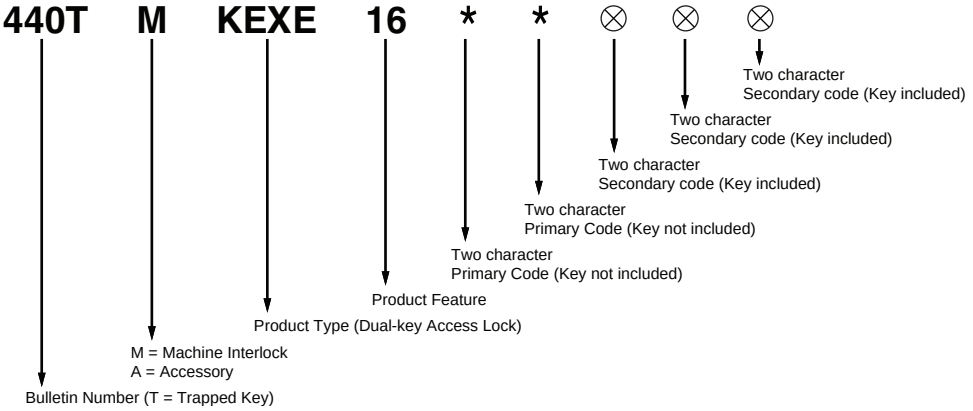
- The codes are added to the end of the cat. no.
- Each code must be two characters in length.
- The first code(s) is the primary code and the last code(s), if necessary, are the secondary code(s).
- Primary codes do not include the key. The key must be ordered separately or must come from a previous operation.
- Secondary codes come complete with a key, as the key is trapped in the code barrel.
- Use the tables on page 3-107 to select and track codes.

Ordering Example 1



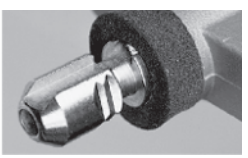
Order Cat. No. 440TMDALE100AAAB to get a Dual key Access Lock with an "AA" primary code and a "AB" secondary code, with a "AB" key included.

Ordering Example 2



Order Cat. No. 440TMKEXE16AAABACACAC to get a key exchange unit with "AA" and "AB" primary codes and three "AC" secondary codes. The "AA" and "AB" keys are not included. The three "AC" keys, which are trapped in the secondary code barrels, are included.

The Prosafe Advantage

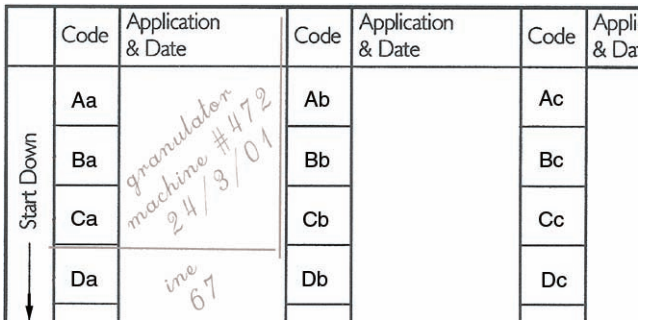


Stainless steel construction.

Key Coding

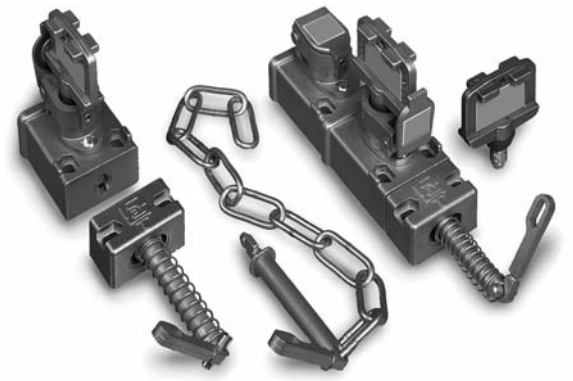
Below is an example reference guide that is useful in selecting and tracking codes. Start down the Aa column as the lower codes (typically Aa to Za) are stocked. The chart continues on to Zz. Note that there are only 24 letters used—O & Q are not used.

Codes are ordered with upper case letters. Labels with two letter codes will show the first letter in the upper case and the second letter in lower case.



Code	Application & Date	Code	Application & Date	Code	Application & Date	Code	Application & Date	Code	Application & Date	Code	Application & Date
Aa		Ab		Ac		Ad		Ae		Af	
Ba		Bb		Bc		Bd		Be		Bf	
Ca		Cb		Cc		Cd		Ce		Cf	
Da		Db		Dc		Dd		De		Df	
Ea		Eb		Ec		Ed		Ee		Ef	
Fa		Fb		Fc		Fd		Fe		Ff	
Ga		Gb		Gc		Gd		Ge		Gf	
Ha		Hb		Hc		Hd		He		Hf	
Ia		Ib		Ic		Id		Ie		If	
Ja		Jb		Jc		Jd		Je		Jf	
Ka		Kb		Kc		Kd		Ke		Kf	
La		Lb		Lc		Ld		Le		Lf	
Ma		Mb		Mc		Md		Me		Mf	
Na		Nb		Nc		Nd		Ne		Nf	
Pa		Pb		Pc		Pd		Pe		Pf	
Ra		Rb		Rc		Rd		Re		Rf	
Sa		Sb		Sc		Sd		Se		Sf	
Ta		Tb		Tc		Td		Te		Tf	
Ua		Ub		Uc		Ud		Ue		Uf	
Va		Vb		Vc		Vd		Ve		Vf	
Wa		Wb		Wc		Wd		We		Wf	
Xa		Xb		Xc		Xd		Xe		Xf	
Ya		Yb		Yc		Yd		Ye		Yf	
Za		Zb		Zc		Zd		Ze		Zf	

Access/Chain Interlocks



Description

The access interlocks are designed to allow access to hazardous areas when an appropriate key is inserted into the interlock. These access interlocks are manufactured in 316L stainless steel to provide rugged, industrial grade method of helping prevent access through gates. They are actuated by either a lever or a rod which is connected to chain.

One advantage of the access interlocks is that there is no need to run power wires to the gate. Power is disconnected by a trapped key rotary switch on a control panel and the key is then hand-carried to the gate by the operator.

The Single-key Access Lock (SAL) and Single-key Chain Lock (SCL) are designed to be used to access hazardous areas where partial body exposure is required. If two keys are needed for partial body access, select the Dual-key Access Lock (DAL) or Dual-key Chain Lock (DCL) with both keys trapped.

When whole body access is needed, the DAL or DCL, with one key trapped and one key free should be used. The secondary key serves the function of a personnel key. The DAL and DCL allow the operator to carry the personnel key into the hazardous area. When the operator returns from the hazardous area and returns the personnel key to the DAL or DCL, the locking sequence can be reversed and the process restarted.

Features

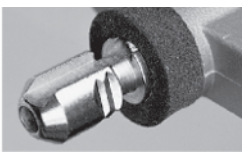
- 316L stainless steel construction
- Direct drive operation
- Fitted with tamper resistant screws
- Stainless steel dust cap as standard
- Replaceable code barrel assembly
- Solenoid and electric versions
- Multiple key options

Specifications

Safety Ratings

Standards	EN1088, ISO12100-1&2, ISO14119, AS4024.1
Category	Cat. 1 per EN 954-1 (ISO 13849-1) Suitable for Cat. 2, 3, or 4 systems
Certifications	CE Marked for all applicable directives and BG; C-Tick not required
Operating Characteristics	
Operating Temperature [C (F)]	Mechanical: -40…+200 ° (-40…+392 °) Electrical: -20…+80 ° (-4…+176 °) Solenoid: -20…+60 ° (-4…+140°)
Relative Humidity	95%
Mechanical Life	100,000 operations
Physical Characteristics	
Misalignment Tolerance	±10 mm (0.39 in.)
Shear Force to Key	15.1 k•N (3398 lbs), max.
Torque to Key	14 N•m (124 lb•in), max.
Material	316L stainless steel
Mounting	SAL and SCL: 2 or 4 x M5 counterbored from top or 2 or 4 x M5 from underside with nuts DAL and DCL: 4 or 6 x M5 counterbored from top or 4 or 6 x M5 from underside with nuts
Weight [kg (lbs)]	SAL and SCL: 0.8 (1.8) DAL and DCL: 1.35 (3)

The Prosafe Advantage



Stainless steel construction.

Product Selection - Mechanical

Type	Actuator Type	Trapped Key Condition	Cat. No.
Single key	Lever	Key trapped to release lever	440T-MSALE10∗
	Chain	Key trapped to release chain	440T-MSCLE10∗
	Extended Lever	Key trapped to release lever	440T-MSALE20∗
Single key with padlock hasp	Lever	Key trapped to release lever	440T-MSALE11∗
	Chain	Key trapped to release chain	440T-MSCLE11∗
Dual key	Lever	Primary key trapped, secondary key free to release lever	440T-MDALE10∗⊗
		Both keys trapped to release lever	440T-MDALE11∗∗
	Chain	Primary key trapped, secondary key free to release chain	440T-MDCLE10∗⊗
		Both keys trapped to release chain	440T-MDCLE11∗∗
Dual key with padlock hasp	Lever	Primary key trapped, secondary key free to release lever	440T-MDALE45∗⊗
Dual key with eject key	Lever	Primary key trapped, secondary spring eject key	440T-MDALJ10∗⊗
	Chain		440T-MDCLJ10∗⊗
Triple key	Lever	One primary trapped, two secondary keys free to release lever	440T-MTALE11∗⊗⊗
	Chain	One primary trapped, two secondary keys free to release chain	440T-MTCLE11∗⊗⊗

∗ Substitute the desired primary code for this symbol (key not included). See 3-107 for code selection.
⊗ Substitute the desired secondary code for this symbol (key included). See 3-107 for code selection.

Product Selection - Electrical

Contact Type	Type	Actuator Type	Trapped Key Condition	Cat. No.
2 N.C. & 1 N.O. break before make	Dual Key	Lever	Both keys trapped to release lever	440T-MDASE21∗∗
			Primary key trapped, secondary key free to release lever	440T-MDASE20∗⊗
		Chain	Both keys trapped to release chain	440T-MDCSE21∗∗
			Primary key trapped, secondary key free to release chain	440T-MDCSE20∗⊗

∗ Substitute the desired primary code for this symbol (key not included). See 3-107 for code selection.
⊗ Substitute the desired secondary code for this symbol (key included). See 3-107 for code selection.

Accessories

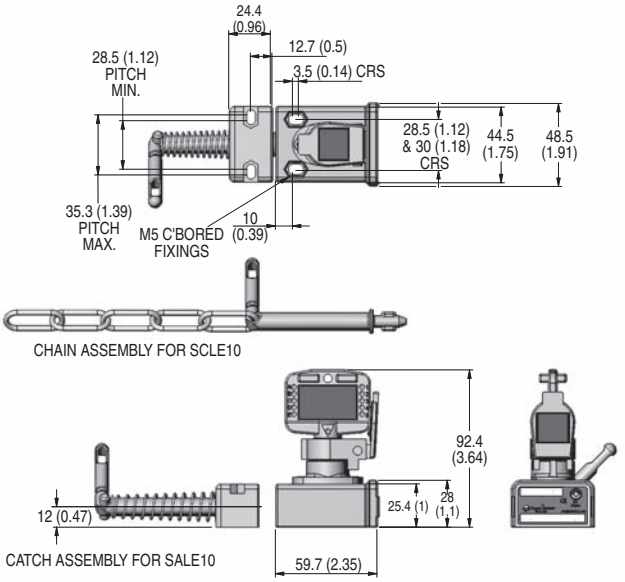
Description	Additional Information	Cat. No.
Stainless steel key	3-140	440T-AKEYE10∗
Stainless steel replacement code barrel with dust cap		440T-ASCBE14∗
Stainless steel weatherproof replacement dust cap		440T-ASFC10∗
Replacement actuator type lever	—	440T-ACAD10
Replacement actuator type chain	—	440T-ACHA10
Stainless steel ejector key	—	440T-AKEYE13∗

∗ Substitute the desired primary code for this symbol (key not included). See 3-107 for code selection.

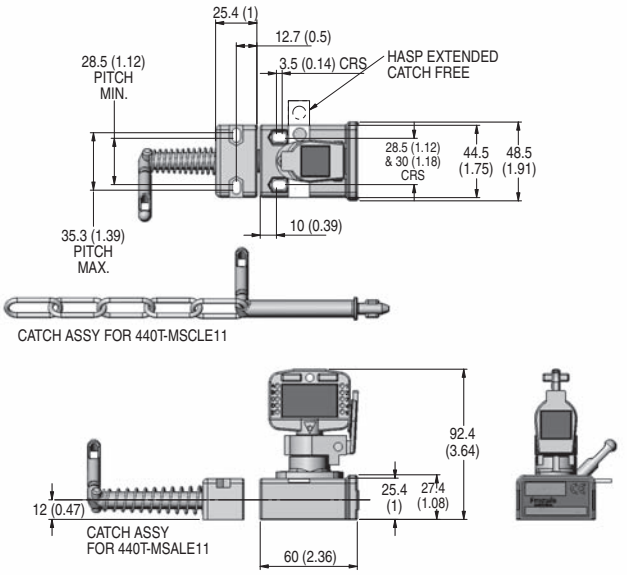
Approximate Dimensions [mm (in.)]

Dimensions not intended to be used for installation purposes.

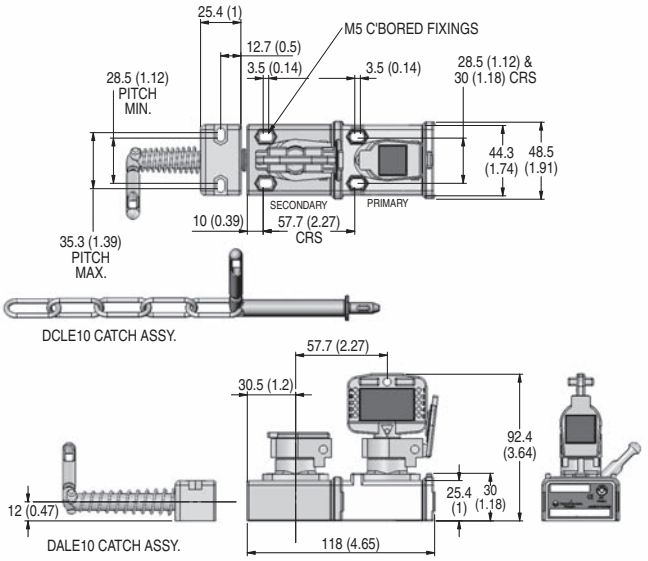
MSALE10



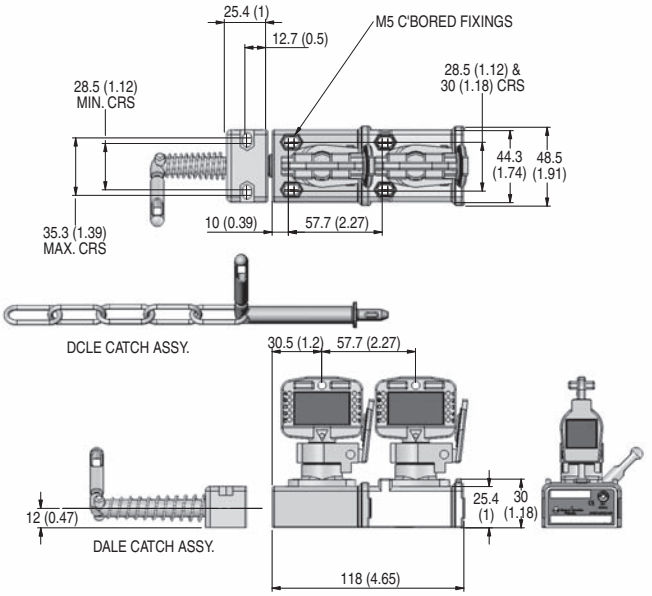
MSALE11



MDALE10 and MDCLE10



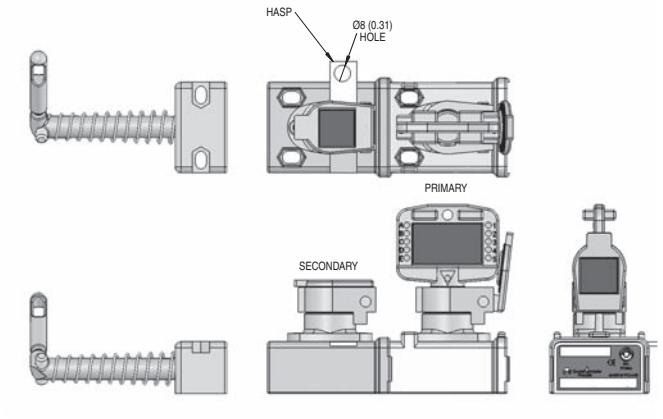
MDALE11



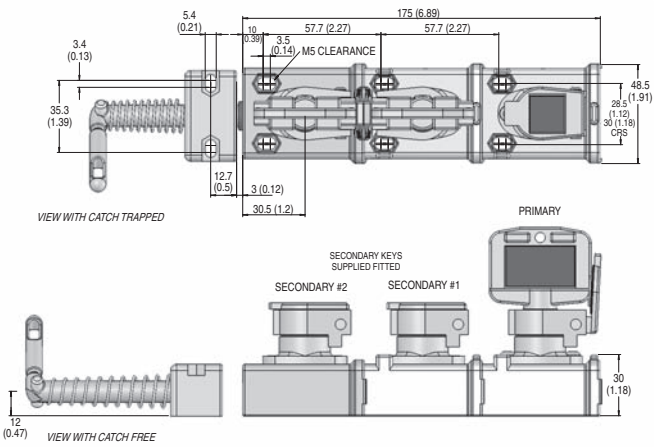
Approximate Dimensions [mm (in.)] (continued)

Dimensions not intended to be used for installation purposes.

MDALE45



MTALE11



MTCLE11