E-Multi™

User Manual

Mold Masters®
performance delivered

Table of Contents

Section 1 - Introduction

We would like to take this opportunity to thank you for purchasing a ***Mold-Masters E-Multi*** Auxiliary Injection Unit (AIU). The purpose of this manual is to assist users in the integration, operation and maintenance of an E-Multi AIU. This manual is designed to cover most system configurations. For additional information, please contact your representative or a *Mold-Masters* office.

Warranty and Documentation

Please check with your order documentation for warranty details.

Documentation will include one or all of the following:

- Parts list containing all system components. Together with the general assembly drawing, the parts list should be referenced when ordering spare parts.
- General assembly drawing.

Important: Please do not return any parts to *Mold-Masters* without pre-authorization and a return authorization number supplied by *Mold-Masters Limited*.

Release Details

Document #	Release Date	Version
AIUUMENXXLT (US Letter format)	Nov 2011	06
AIUUMENXXA4 (A4 format)	Nov 2011	06

Trademarks and Patents

ACCU-VALVE, DURA, FLEX-DURA FLEX-SERIES, FUSION-SERIES, HOT EDGE, INJECTIONEERING, MASTERPROBE, MASTER-SHOT, MOLD-MASTERS, MELT-DISK, MOLD-MASTERS ACADEMY, MASTER-SERIES, MASTERSOLUTION, MASTERSPEED, MERLIN, MOLD-MASTERS SYSTEM, SCAN-MASTER, STACK-LINK, are the registered trademarks of MOLD-MASTERS (2007) LIMITED.

Information contained herein is, to our best knowledge, true and accurate, but all recommendations or suggestions are made without guarantee. Since the conditions of use are beyond our control, Mold-Masters disclaims any liability incurred in connection with the use of our products and information contained herein. No person is authorized to make any statement or recommendation not contained herein, and any such statement or recommendation so made shall not bind Mold-Masters. Furthermore, nothing contained herein shall be construed as a recommendation to use any product in conflict with existing patents covering any products or its use, and no license implied or in fact granted herein under the claims of any patents.

May be manufactured under one or more of the following U.S. Patents:

5118279, 5135377, 5142126, 5148594, 5206040, 5217730, 5223275, 5227596, 5227181, 5235737, 5238378, 5238391, 5268184, 5269676, 5282735, 5284436, 5299928, 5312242, 5326251, 5334008, 5334010, 5346388, 5366369, 5366370, 5387099, 5405258, 5421716, 5427519, 5429491, 5437093, 5441197, 5443381, 5460510, 5474440, 5494433, 5496168, 5507635, 5507636, 5536165, 5591465, 5599567, 5614233, 5641526, 5644835, 5652003, 5658604, 5695793, 5700499, 5704113, 5705202, 5707664, 5720995, 5792493, 5795599, 5820899, 5843361, 5849343, 5853777, 5935615, 5935616, 5935621, 5942257, 5952016, 5980236, 6009616, 6017209, 6030198, 6030202, 6062841, 6074191, 6077067, 6079972, 6095790, 6099780, 6113381, 6135751, 6162043, 6162044, 6176700, 6196826, 6203310, 6230384, 6270711, 6274075, 6286751, 6302680, 6318990, 6323465, 6348171, 6350401, 6394784, 6398537, 6405785, 6440350, 6454558, 6447283, 6488881, 6561789, 6575731, 6625873, 6638053, 6648622, 6655945, 6675055, 6688875, 6701997, 6739863, 6752618, 6755641, 6761557, 6769901, 6776600, 6780003, 6789745, 6830447, 6835060, 6840758, 6852265, 6860732, 6869276, 6884061, 6887418, 6890473, 6893249, 6921257, 6921259, 6936199, 6945767, 6945768, 6955534, 6962492, 6971869, 6988883, 6992269, 7014455, 7018197, 7022278, 7025585, 7025586, 7029269, 7040378, 7044191, 7044728, 7048532, 7086852, 7105123, 7108502, 7108503, 7115226, 7118703, 7118704, 7122145, 7125242, 7125243, 7128566, 7131832, 7131833, 7131834, 7134868, 7137806, 7137807, 7143496, 7156648, 7160100, 7160101, 7165965, 7168941, 7168943, 7172409, 7172411, 7175419, 7175420, 7179081, 7182591, 7182893, 7189071, 7192268, 7192270, 7198740, 7201335, 7210917, 7223092, 7238019, 724418, 7252498, 7255555, 7258536, 7270538, 7303720, 7306454, 7306455, 7314367, 7320588, 7320589, 7320590 7326049, 7344372, 7347684, 7364425, 7364426, 7370417,7377768, 7381050, 7396226, 7407379, 7407380, 7410353, 7410354, 7413432, 7416402, 7438551, 7462030, 7462031, 7462314, 7465165, 7470122, 7507081, 7510392, 7513771, 7513772, 7517214, 7524183, 7527490, 7544056, 7547208, 7553150, 7559760, 7559762, 7565221, 7581944, 7611349, 7614869, 7614872, 7618253, 7658605, 7658606, 7671304, 7678320, 7686603, 7703188, 7713046, 7722351, 7731489, 7753676, 7766646, 7766647, 7775788, 7780433, 7780434, 7794228, 7802983, 7803306, 7806681, 7824163, 7845936, 7850442, 7874833, 7877163, 7891969, 7918660, 7918663, 7931455, 7963762, D525592, RE38265, RE38396, RE38920, RE39935, RE40478, RE40952, RE41536E, RE41648E+ Pending.

Section 2 - Global Support

Manufacturing Facilities

GLOBAL HEADQUARTERS
CANADA
Mold-Masters (2007) Limited
233 Armstrong Avenue
Georgetown, Ontario
Canada L7G 4X5
tel: +1 (905) 877 0185
fax: +1 (905) 873 2818
info@moldmasters.com

EUROPEAN HEADQUARTERS
GERMANY / SWITZERLAND
Mold-Masters Europa GmbH
Postfach/P.O. Box 19 01 45
76503 Baden-Baden, Germany
Neumattring 1
76532 Baden-Baden, Germany
tel: +49 7221 50990
fax: +49 7221 53093
europe@moldmasters.com

ASIAN HEADQUARTERS
CHINA/HONG KONG/TAIWAN
Mold-Masters (KunShan) Co, Ltd
Zhao Tian Rd
Lu Jia Town, KunShan City
Jiang Su Province
People's Republic of China
tel: +86 512 86162882
fax: +86 512-86162883
mmc-sales@moldmasters.com

SOUTH AMERICAN HEADQUARTERS
BRAZIL
Mold-Masters do Brasil Ltda.
Rua Hum, 1106 e 1126 -
Jd. Manchester - Nova Veneza
Sumare - São Paulo Brasil
CEP 13178-440
tel: +55 19 3922 4265
fax: +55 19 3922 4266
vendas@moldmasters.com.br

INDIA
Mold-Masters Technologies
Private Limited
247, Alagesan Road,
Shiv Building, Saibaba Colony.
Coimbatore T. N.
India 641 011
tel: +91 422 423 4888
fax: +91 422 423 4800
mmtplinfo@moldmasters.com

JAPAN
Mold-Masters K.K.
1-4-17 Kurikidai, Asaoku
Kawasaki, Kanagawa
Japan, 215-0032
tel: +81 44 986 2101
fax: +81 44 986 3145
info@mmkk.co.jp

UNITED KINGDOM
Mold-Masters (UK) Ltd
Netherwood Road
Rotherwas Ind. Est.
Hereford, HR2 6JU
United Kingdom
tel: +44 1432 265768
fax: +44 1432 263782
uk@moldmasters.com

U.S.A.
Mold-Masters Injectioneering LLC
103 Peyerk Court
Romeo, MI 48065, USA
tel: +1 800 450 2270 (USA only)
tel: +1 (586) 752-6551
fax: +1 (586) 752 6552
mmi-inq@moldmasters.com

Regional Offices

AUSTRIA / East and South East Europe
Mold-Masters Handelsges.m.b.H.
Pyhrnstrasse 16
A-4553 Schlierbach
Austria
tel: +43 7582/51877
fax: +43 7582/51877 18
at@moldmasters.com

CZECH REPUBLIC
Mold-Masters Europa GmbH
Hlavni 823
75654 Zubri
Czech Republic
tel: +420 571 619 017
fax: +420 571 619 018
cz@moldmasters.com

FRANCE
Mold-Masters France
ZI la Marinière,
2 Rue Bernard Palissy
91070 Bondoufle
tel: +33 1 82 05 00 80
fax: +33 1 82 05 00 83
fr@moldmasters.com

KOREA
Mold-Masters Korea Ltd
708 Byucksan Digital Valley 5 Cha,
60-73 Gasan-dong, Geumcheon-gu,
Seoul,153-788,South Korea
Tel:+82 2 2082 4755
Fax:+82 2 2082 4756
mmkr-sales@moldmasters.com

MEXICO
MM Hot Runner Injection México,
S.A. de C.V.
Av. San Carlos No. 4 – Nave 2
Parque Industrial Lerma
Lerma, Estado de México
52000, México
tel: +52 728 282 48 33
fax: +52 728 282 47 77
mexico@moldmasters.com

POLAND
Mold-Masters Europa GmbH
Skr. Pocztowa 59
00-908 Warszawa
Poland
tel: +48 (0) 66 91 80 888
fax: +48 (0) 66 91 80 208
pl@moldmasters.com

Regional Offices - Con't.

SINGAPORE / MALAYSIA
INDONESIA / THAILAND
Mold-Masters Singapore PTE. Ltd.
No 48 Toh Guan Road East
#06-140 Enterprise Hub
Singapore 608586
Republic of Singapore
tel: +65 6261 7793
fax: +65 6261 8378
mmsinfo@moldmasters.com

SPAIN
Mold-Masters España
Serennia Business Center
Buenos Aires 37-29
08902 Hospitalet de Llobregat
Barcelona, Spain
tel: +34 93 802 36 01
fax: +34 93 802 49 08
es@moldmasters.com

International Representatives

Argentina
Sollwert S.R.L.
La Pampa 2849 2∫ B
C1428EAY Buenos Aires
Argentinia
tel: +54 11 4786 5978
fax: +54 11 4786 5978 Ext. 35
sollwert@fibertel.com.ar

Australia
Comtec I P E
1084 South Road,
Edwardstown, South Australia 5039
PO Box 338, Magill,
South Australia 5072
tel: +61 8 8374 4633
fax: +61 8 8299 0892
bparrington@comtecipe.com

Bulgaria
Mold-Trade OOD
62, Aleksandrovska St.
Ruse City
Bulgaria
tel: +359 82 821 054
fax: +359 82 821 054
contact@mold-trade.com

Denmark, Norway, Sweden
Englmayer A/S
Skenkelsoevej 9, Postbox 35
DK - 3650 Oelstykke, Denmark
tel: +45 46 733847
fax: +45 46 733859
support@englmayer.dk

Finland
Oy Scalar Ltd.
Viertolantie 12
11120 Riihimaki, Finland
tel: +358 19 783 191
fax: +358 19 783 190
info@scalar.fi

Israel
ASAF INDUSTRIES Ltd.
29 Habanai Street
PO Box 5598 Holon 58154
Israel
tel: +972 3 5581290
fax: +972 3 5581293
sales@asaf.com

Italy
Commerciale Isola SPA
Via G.B. Tiepolo 3
35010 Cadoneghe, (Padova), Italy
tel: +39 49 706600
fax: +39 49 8874231
info@com-isola.it

Portugal
Gecim LDA
Rua Fonte Dos Ingleses, No 2
Engenho
2430-130 Marinha Grande, Portugal
tel: +351 244 575600
fax: +351 244 575601
gecim@gecim.pt

Romania
International Mold Trade Co. SRL
Str. Constantin Aricescu, Nr. 21
Bl. 20, Sc. 2, Apt. 20
Bucharest - Sector 1, Romania
tel: +4 021 230 60 51
fax : +4 021 231 78 43
contact@matritehightech.ro

Turkey
MMG Consulting & Engineering
Yesil Çesme Sok No:30/3
Çiftehavuzlar 81060, Istanbul, Turkey
tel: +90 216 357 0783
fax: +90 216 385 0656
mmgevrek@superonline.com

Vietnam
Lotus Chemical Technology
393 Dien Bien Phu St., Ward 4, Dist. 3,
HoChiMinh City, Vietnam
tel: +84 8 832 7605,
fax: +84 8 832 7730
dieuphuoc.nguyen@lotusfirma.com

Section 3 - Safety

Symbols

The following symbols are used in this manual to highlight important information.

WARNING
Safety warning indicates a potentially hazardous situation, which if not avoided, could result in serious injury or death.

CAUTION
Caution indicates that damage to equipment is possible if instruction is not followed.

IMPORTANT
Important indicates useful additional information or is used as a reminder of important information.

Introduction

Any instructional material provided by *Mold-Masters* for the operation and maintenance of the E-Multi Auxiliary Injection Unit (AIU) does not in any way absolve the employer from fulfilling the following obligations and *Mold-Masters* disclaims liability for injury to personnel using equipment supplied.

It is the responsibility of the employer to:

- Ensure the original and continuing competence of personnel caring for, setting up, inspecting and maintaining injection molding equipment.
- Establish and follow a program of periodic and regular inspections of injection molding equipment to ensure they are in safe operating condition and proper adjustment.
- Ensure that no modifications, repairs, or rebuild of portions are made to the equipment that reduce the level of safety existing at time of manufacture or remanufacture.

General Safety Warnings

- The equipment supplied is subjected to high injection pressures and high temperatures.
- Exercise caution when working around the barrel and wear heat resistant gloves if necessary.
- Do not operate the equipment with unconfined long hair, loose clothing or jewelry, including name badges, neckties, etc. These may get caught by the moving belt mechanism and can cause serious injury or death.
- Never disable or bypass a safety device.
- It is highly recommended that all operators wear appropriate personal protective equipment when working with injection molding machines.
- Check frequently for possible oil or water leaks. If necessary, stop the machine and make repairs.
- When performing maintenance work always ensure molding machine lock out / tag out of all sources of power. Unplug and lock out the controller before performing any maintenance work.
- The AIU is designed to be run with the guards in place. Do not run the machine with guards removed. If guard removal is required for maintenance, replace guards once maintenance has been performed. Do not modify guards.

General Cautions

Please note the following general cautions:

- The AIU must be connected to a water-cooling system for proper performance. Maintain water temperature above the dew point to prevent condensation from forming on the machine.
- Don't climb or stand on machine when performing maintenance.
- Use only specified lifting points when installing or moving the machine.
- Always replace pinched or damaged thermocouples.
- Always operate the system using correctly installed "J" type thermocouples.

Handling and Lifting Precautions

When lifting the AIU, follow the procedures outlined in *"Lifting the AIU" on page 10-8*.

- Choose lift equipment that is rated for the prescribed load.
- Use recommended attachment points only. See *"Lifting the AIU" on page 10-8*.
- Define the load path (the path and orientation the item will move in while it is being lifted, and the location and orientation where it will be set down).
- Identify and avoid potential pinch points (where an individual or a component of the lifting equipment or load may be caught between two surfaces).
- Secure and balance the load in the chain or lifting device before it is lifted more than a few inches.
- Minimize swinging by bringing the hook over the load appropriately.
- Inch powered hoists slowly into engagements with loads.

Controller Safety

Most controller warnings pertain to electrical hazards. It is crucial to comply with these warnings to minimise any personal danger.

- DO NOT enter the cabinet without first ISOLATING the supplies – there are unguarded terminals inside the cabinet which may have a dangerous potential across them.
- Where a three-phase supply is used, this potential may be 415 volts or higher.
- High voltage and current cables are connected to the controller. There is also a high voltage cable connection between the servo motor and controller. Lock out electrical power before disconnecting or connecting electrical cables.
- For all E-Multi Controllers, the main power switch is a rotary switch at the rear of the cabinet. This switch is rated to safely disconnect the total load current during switch "On" and switch "Off". You can use a suitably-sized padlock, or similar device to lock the switch in the "Off" position to prevent operation during maintenance.

Section 4 - Overview

Standard Features - AIU

- Free standing control cabinet for 460 V 3 Ø or 400 V 3 Ø
- 10 meter cable length to allow flexible installation
- 15 inch touch screen HMI
  - Process graphing
  - Process data monitoring
  - Security user login profiles for administrator to operator
- Language switching (English, German, Chinese)
- Metric / imperial unit switching
- Servo axes control for injection and screw rotation
- DC motor control for carriage movement
- Linear bearing for guiding injection housing and barrel housing
- Water cooled barrel housing
- Closed loop injection speed & pressure control
  - 10 injection speed profiles, 100 mm/s maximum injection velocity
  - 10 hold pressure profiles
- Closed loop screw speed
  - 5 back pressure profiles
- Screw ring check
- Standard Euromap 67 and SPI interfaces for IMM and robot
- Single ready button to set unit to standby
- Selectable triggering signal
- 220 V barrel heaters
  - J type thermocouple feedback
  - Keep barrel warm feature

Standard Features - Controller

The following are general features. The actual controller/console supplied may have contractual variations and differ in some specified options.

- Supply voltage 400 V or 460 V 3 Ø 50/60 Hz Delta, no neutral. The control cabinet can be manufactured to accept a wide range of supply voltages and sequence of phases.
- Voltage bandwidth: stable within ±20% supply voltage swing
- Supply earth-leakage trip: 10 mA per individual zone ground fault monitoring for tool protection
- Overload protection: miniature circuit breaker
- Mains voltage output pattern: burst-fired with zero voltage crossover and phase angle fired
- Temperature control method: closed-loop (auto) or open-loop (manual) with *Mold-Masters* software
- Control range: 160 - 400 Centigrade (Celsius)
- Temperature Scale: Centigrade (Celsius) or Fahrenheit
- Printer output connector: USB printer port
- Alarm output: closing contact relay 5 Amp max

Figure 1: E-Multi AIU

Figure 2: E-Multi Controller

Components

E60 Shown
(E490 similar)

1. **Support beam**
The backbone of machine. All components connect to the support beam.

2. **Injection housing**
Provides injection pressure for machine.

3. **Injection motor**
Provides power to injection housing.

4. **Barrel housing**
Provides material to barrel for injection.

5. **Screw motor**
Provides power for the feed screw.

6. **Barrel / Feed Screw**
Used for conveying molten plastic into the mold.

7. **Heaters**
Used to maintain proper barrel temperature to keep plastic at proper consistency for injection.

8. **Feed block**
Where plastic pellets are fed into the barrel.

9. **Drive belt**
Connects the two ball screws so they drive together.

10. **Mounting holes**
Used for attaching the AIU to the adapter plate.

11. **Linear actuator**
Used to engage the nozzle tip with the manifold inlet.

12. **Vibrator**
Used to help plastic pellets feed properly into the feed block.

13. **Pressure transducer**
Gives pressure feedback to controller (pressure inside injection housing).

14. **Oil fill / bleed manifold**
Used for filling and pressurizing injection housing with oil.

15. **Electrical connections**

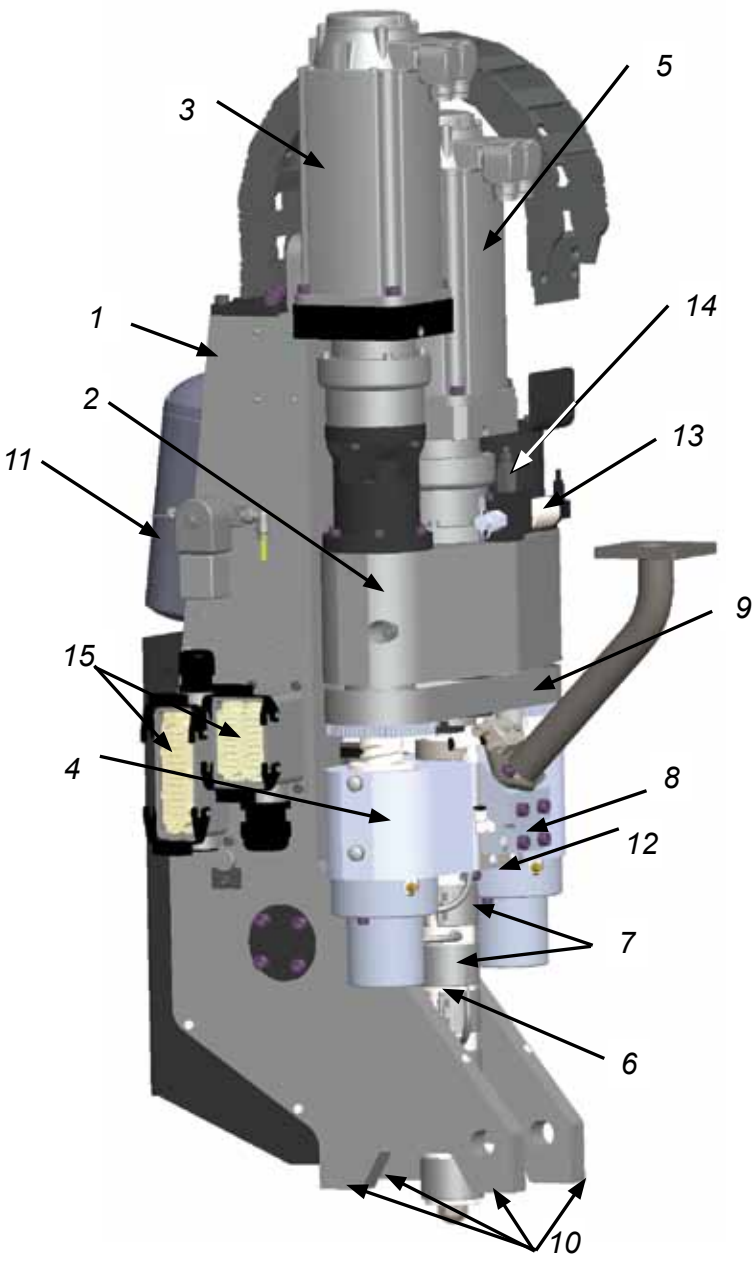


Figure 3: E-Multi Components (Guards Removed for Clarity)

Section 5 - Preparation

Unpacking

1. Crate should be moved using a forklift or pallet truck. If using a crane, then crate must be slung from underneath. Never lift from the top of the crate.
2. Remove accessory boxes, manual and anything other than the AIU.
3. Remove plastic wrap as necessary.
4. Remove the four 3/8" lag screws from the ends of the shipping brackets using a 9/16" or 14mm socket.
5. The AIU ships with lifting hardware installed. Use a two leg chain bridle to remove the AIU from the crate.

Figure 4: E-Multi Unpacking

Shipment Contents

- E-Multi AIU
- Documentation package (user manual, mechanical and electrical drawings)
- Lifting kit
- Horizontal and Vertical Feed Block
- Vertical Feed Tube
- Oil fill kit (option for maintenance for any E-Multi unit). Part # EMULTIFILLKIT01

Figure 5: Oil Fill Kit

Receiving Inspection

1. Check that the AIU has not been damaged in transit.
2. Check all wires and cables. Ensure they are not kinked or damaged and are still connected properly.
3. Check for oil leaks on the machine. If oil is visible, find the source of the leak and correct. Check oil level as described in *"Checking Oil level" on page 10-2.*

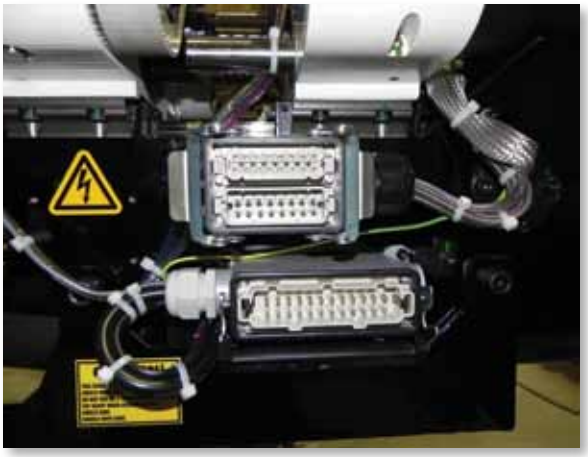


Figure 6: E-Multi Wiring and Connectors

Section 6 - Installation

WARNING

- Lock out / tag out controller before installation.
- Put molding machine into mold change mode.
- Ensure mounting hardware is capable of supporting the expected load. Torque mounting hardware to correct torques. See *"Torque Specifications" on page 10-17.*
- Ensure all lifting devices are rated for the load.
- Use correct lifting points. See *""Lifting the AIU" on page 10-8.*

CAUTION

- E-Multi is designed to be used only with molds capable of accepting auxiliary injection units.
- Ensure E-Multi placement will not interfere with injection molding machine movement.

Attaching AIU to Mold / Machine

NOTE
Please reference installation drawing supplied with unit for complete information on services and connections.

1. Clean the molding machine and mold where the AIU will be mounted. Any plastic residue on the manifold inlet must be removed to ensure proper nozzle contact.
2. Install adapter plate onto AIU. See *"Installing Adapter Plate onto AIU" on page 10-12.*
3. Verify that AIU carriage is retracted to prevent bending the carriage link.
4. a) For vertical installations, lift the AIU into place above the manifold inlet and install screws. Torque in a crosswise pattern.
   b) For horizontal installations, move the AIU into place beside the manifold inlet and install screws. Verify stand is at the correct height and install screws. Torque in a crosswise pattern.

Controller Installation

CAUTION

- The AIU controller should be installed in a clean, dry environment where the ambient conditions do not exceed the following limits.
  - Temperature: 0 to +35°C.
  - Relative Humidity: 90% (non-condensing)
- It should be located in such a way that the main disconnect is easily accessible in case of emergency.
- The AIU controller supply should have a fused disconnect or main circuit breaker according to local safety codes. Refer to the serial plate on the controller cabinet for confirmation of the supply requirements. If the local supply is outside the specified range, please contact *Mold-Masters* for advice.
- The cable used to connect the AIU controller to the disconnect should be sufficient for the maximum load of the AIU.

1. Install a strain relief into the supply cable hole on the connector side of the controller.
2. Remove disconnect terminal cover.

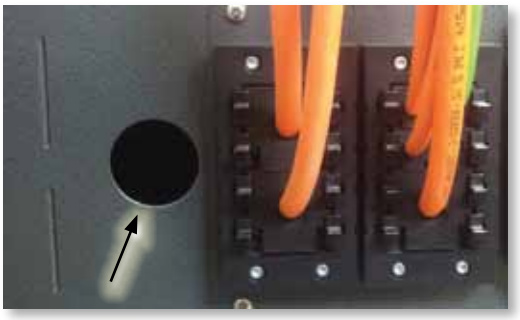


Figure 7: Controller Supply Cable Hole

3. Feed supply cable through strain relief and route wires to disconnect and ground. See *"Figure 8: Controller Power Connection Points"*. Disconnect screws using a 5mm hex driver.
4. Replace disconnect terminal cover.

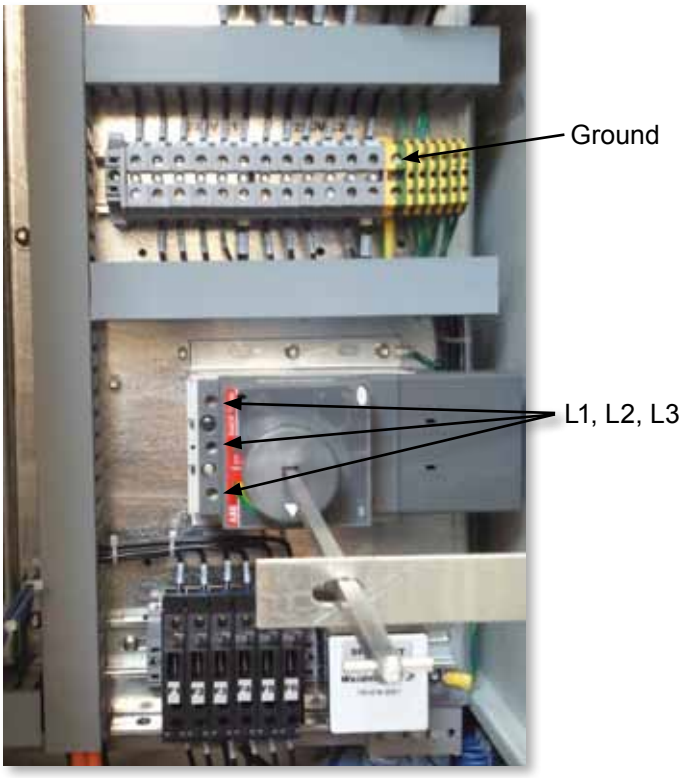


Figure 8: Controller Power Connection Points

Section 7 - System Set-Up

Connecting the Controller to the AIU

There are six cables that connect the controller to the AIU. There are two servo power cables, two servo encoder cables, one heater cable and one I/O cable. The motor power and encoder cables need to be routed through the cable track before being connected to the motors. The heater and I/O cables can be connected directly, and all the cables should be routed so they do not interfere with the mold or molding machine operation.

Connecting the Servo Cables and Routing them through the Cable Track

1. Uncoil the servo cables and make sure they are not kinked or twisted. Check the cables for nicks or other damage from shipping.

NOTE
For the next steps the method to open the cable track crossbars is different for E60 and E490 models.

For E60 models:

2. Open the cable track crossbars by inserting a small flat screwdriver into the small opening at the end of the crossbar and prying the crossbar away from the cable track. Take care that none of the cable separators fall out.

Figure 9: E60 Cable Track

3. Close the crossbars by tapping with a rubber mallet.

Figure 10: Closing Crossbars.

For 490 models:

4. Open the crossbars by inserting a small flat head screw driver into one side of the slot in the cross-bar and prying down, and then the other. To close the crossbar, fold it down and put the tab into one side of the slot, and then tap closed with a rubber mallet.

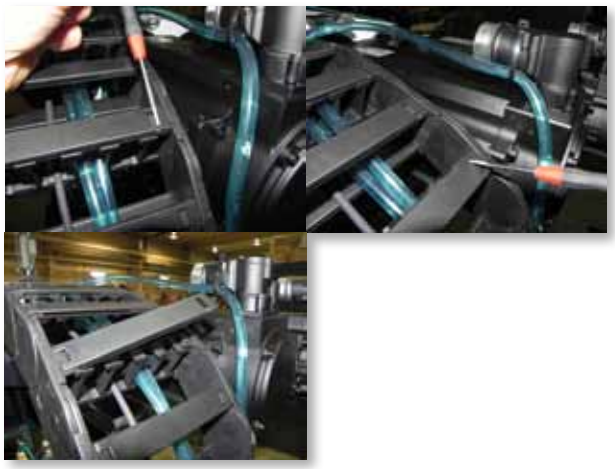


Figure 11: E490 Cable Track

5. Once the crossbars are all open, route the servo power cables on the side of the track closest to the machine, and the servo feedback cables on the side furthest from the machine.

Figure 12: E60 Servo Cable Routing

Figure 13: E490 Servo Cable Routing

6. Connect the servo cables to the motors. See below for correct connector alignment. Take care that the cables are connected to the correct motors. Cables and motors are both clearly labeled.

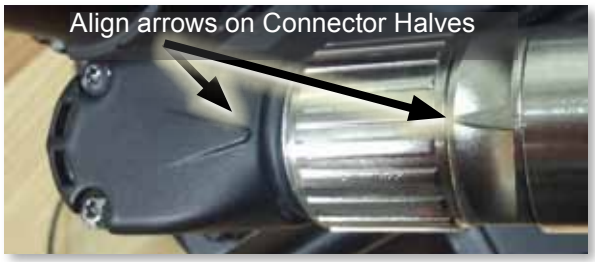


Figure 14: Connector Alignment

7. Once cables have been routed, use wire ties to hold cables in place.

Figure 15: Using Wire Ties to Hold Cables in Place

Connecting and Routing Heater and I/O Cables

1. Uncoil the heater and I/O cables and make sure they are not kinked or twisted. Check the cables for nicks or other damage from shipping.
2. Connect the “MOLD END” of the heater cable to the connector on the AIU.
3. Connect the “MOLD END” of the I/O cable to the connector on the AIU.
4. Route the cables towards the motor end of the AIU, taking care not to interfere with any moving parts or obstructing the air connection. The cables may be tied to the motor end shipping bracket as required.
5. Connect the “CONTROLLER END” of the cables to the “BARREL HEAT CONNECTOR” and “AUX INJ. UNIT” connectors on the controller.

Figure 16: Barrel Heat Connector

Connecting Pneumatic and Cooling connections

1. Install a 1/8NPT fitting (customer supplied) into the vibrator needle valve.
2. Install two 1/4NPT fittings (customer supplied) into the cooling connector bulkheads.
3. Connect a clean, dry, non-lubricated air supply not exceeding 120 psi to the vibrator needle valve.
4. Open the air supply slowly, check for leaks and correct if necessary.
5. Connect water supply to left bulkhead connector and return to right bulkhead connector.

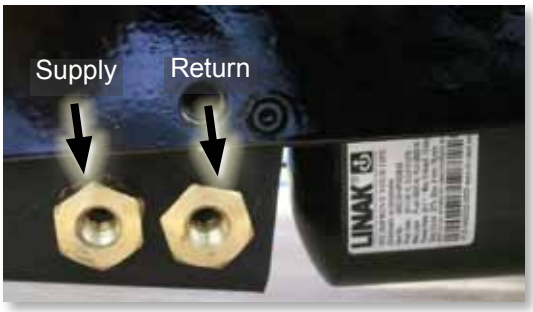


Figure 17: Water Supply Connections

Connecting the Controller to the Molding Machine

E-Multi units are compatible with both E67 and SPI injection machines. Depending on the configuration, the controller is shipped with either a standard E67 cable, a hybrid E67 to SPI adapter cable or a standard E67 cable and an SPI to E67 adapter plug. In all cases, the E67 “CONTROLLER END” of the cable connects directly to the “IMM E67” connector on the controller, and the “IMM END” connects either directly to the molding machine or to the adapter plug, which plugs into the molding machine.

Figure 18: Controller Cable Connections

Connecting a Robot to the Controller

E-Multi units are compatible with both E67 and SPI robots. In all cases, the controller is shipped with a robot jumper plug.

Figure 19: Robot Jumper Plug - Top + Side

If no robot is used, connect the robot jumper plug to the “ROBOT E67” connector on the controller.
If an E67 robot is to be used, connect the robot’s E67 cable to the “ROBOT E67” connector on the controller.
If an SPI robot is to be used, attach the supplied “ROBOT SPI ADAPTER” to the “ROBOT E67” connector on the controller, and connect the robot’s SPI cable into the “ROBOT SPI ADAPTER.”

Connecting a Handheld HMI (optional)

E-Multi units are available with optional handheld HMI units to allow control of the E-multi when access to the controller is inconvenient. The handheld HMI connects to the “HANDHELD HMI” connector on the controller.

Figure 20: Handheld HMI (left) and Controller Connection (right)

Calibrate Carriage Home Position

The first time the AIU is installed, and any time it is transferred to a new machine with a different mold, the carriage home position must be calibrated. See *"Carriage Home Position Calibration" on page 10-16*.

Section 8 - Start Up / Shut Down

Introduction

Before the AIU can be used, the controller will need to be set up.
Please see *"Touch Screen Interface" on page 9-2* for details on setting parameters such as:

- Heating
- Control
- Injection speeds
- Trigger signals, etc.

Controller Start Up and Shut Down

For all E-Multi Controllers, the main power switch is a rotary switch at the rear of the cabinet. This switch is rated to safely disconnect the total load current during switch “On” and switch “Off”.

You can use a suitably-sized padlock, or similar device to lock the switch in the “Off” position to prevent operation during maintenance.

Figure 21: Main Power Switch

Although the main switch has the capacity to switch the whole system “Off”, it is recommended that this is only done in an emergency. The controller uses computer technology and should be switched off in stages. A sequenced method for switching “On” and “Off” protects the console and keeps the switched load to a minimum to extend the life of the main isolator.

Switching On

When the main power switch is turned to “On”, the servo motors will not be enabled.
Once the computer completes its preamble, the display will show the “Overview” page. At this point the system is in “Manual” mode and is ready to have the heaters switched on to bring the barrel heaters to temperature.
Servos may be enabled by pressing the “F10” button on the button strip located below the display. Once the servos are enabled, the LED at the top left of the button will turn on.

The E-Multi controller can be used in “Manual”, “Setup” and “Auto/Ready” mode.

Switching Off (or Shutting Down)

Mold-Masters recommends that you use the console to shut down the heating load, and only use the main isolator to switch off the controller once it is a dormant controller.

1. Shut down the heating. Press the “F8” button located on the button strip located below the display. The LED at the top left of the F8 button indicates heating status; if the LED is lit, heating is active, otherwise, heating is off.
2. Shut down the controller. Once heating has been turned off, the system may be turned off using the rotary disconnect on the back of the controller.

Section 9 - E-Multi Controller

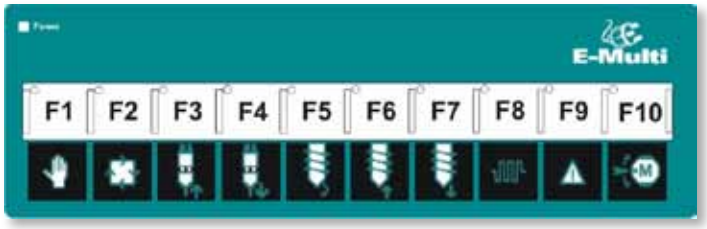
Introduction

This part of the manual describes the Touch Screen Interface or Human Machine Interface (HMI) and shows what functions and information are available.
The console housing contains all components necessary to generate displays and information for the control cabinet and includes a USB port. Ethernet connections are also provided. From the various screens, software on the screen allows you to:

- Set individual nozzle temperatures. Set high and low temperature limits for closed loop zone control.
- Configure and calibrate nozzle position and contact force.
- Create mold specific setups (recipes). These can be stored and called up when molds are changed.
- Configure the injection sequence and monitor it.
- Configure the hold sequence and monitor it.
- Configure the plasticize sequence and monitor it.
- Use the oscilloscope functionality to monitor operation.
- Control the password protection on all settings.
- Print out any displays or data listings.
- Connect and monitor Euromap connection between the E-Multi, molding machine and robot.

Cabinet Mounted Control Buttons

The cabinet mounted buttons control frequently used functions to help prevent excess wear on the touch screen.



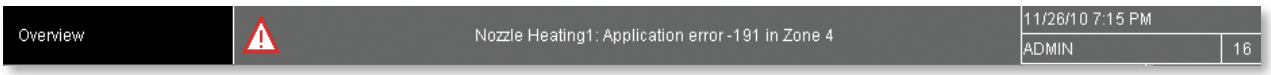
Button	Description	Button	Description
	**F1 Manual/Setup Mode** E-Multi will not be controlled by the molding machine in this mode. This mode is used for setup functions and jogging motors.		**F2 Ready/Auto Mode** E-Multi will be triggered by the molding machine depending on the E-Multi triggering method selected. See Appendix A: Euromap 67.

Button	Description	Button	Description
	**F3 Carriage Move Retract** The carriage can be retracted by placing the E-Multi in “Manual/Setup” mode and pressing this button.		**F4 Carriage Move Advance** The carriage can be advanced by placing the E-Multi in “Manual/Setup” mode and pressing this button.
	**F5 Screw Rotate** The screw can be rotated by placing the E-Multi in “Manual/Setup” mode and pressing this button. The screw will rotate until you press this button again to turn it off.		**F6 Screw Retract** The screw can be retracted by placing the E-Multi in “Manual/Setup” mode and pressing this button.
	**F7 Screw Advance** The screw can be advanced by placing the E-Multi in “Manual/Setup” mode and pressing this button.		**F8 Nozzle Heaters** The nozzle heaters can be turned off/on at any time with this button. Note: If the heater temperature is outside the preset limits, the E-Multi will not operate and an error will be displayed.
	**F9 Acknowledge/Reset current alarms** Any current alarms will be acknowledged and a reset will be attempted when this button is pressed.		**F10 Enable Servo Motors** The injection and screw servo axis motor control is enabled by pressing this button. The LED on the top left corner of this button will light up when the drives are enabled. No motion will occur if this button is not lit up.

Touch Screen Interface

Status Display

The status display is located at the top of the screen and is always shown
The status display has 5 boxes of information:

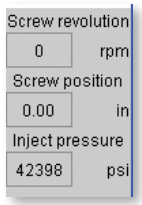
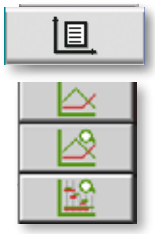


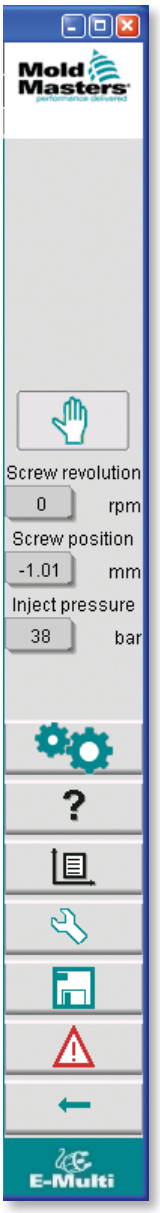
Element	Description
	Current screen being displayed.
	Warning / error status messages.
	The current date and time.
	The current user.
	The access level of the current user.

System Button Bar

On the right hand edge of each screen is the system button bar. The bar displays basic system information and controls basic functionality.

To operate functions simply touch the button using either your fingers or a blunt pointer.

Element	Description
	Current Live Status. The live values displayed at this location are always displayed no matter what screen you are on.
	Mode Status. An icon will be displayed at this location to indicate the current function being performed as well as the current machine mode. See "*Runner Icon Description*" below for a description of the various icons that could be displayed.
	Operation Mode Select. This button allows the user to select between three available operation modes: Manual Mode. Machine will jog at full speed. Set up Mode. Machine will jog at set up speed. Set up speed and accel/decel ramps are configurable by user. See Ramps. Ready/Standby Mode. Machine will operate automatically when the molding machine provides the proper trigger and the EuroMap connections from the molding machine and robot are correct.
	Help documentation. Pressing this button will provide help documentation (if available) for the current screen being displayed.
	Process Data Tools. These buttons allows the user to view process data in various formats. See *PD-Protocol and PD-Cycle Time Data Screens* for more information. Display selected process data in a tabular format. Display process data in a graphical format. Display process data in a graphical format with SPC. Display Cycle Time Data Analysis.
	System Set Up. Use to adjust system settings for the touch screen interface and to display system information.
	Mold Data. This data is specific to each mold used with the E-Multi. Mold settings can be saved and loaded again at any time through the HMI screen. See "*Screen Functionality Descriptions*" for more information.

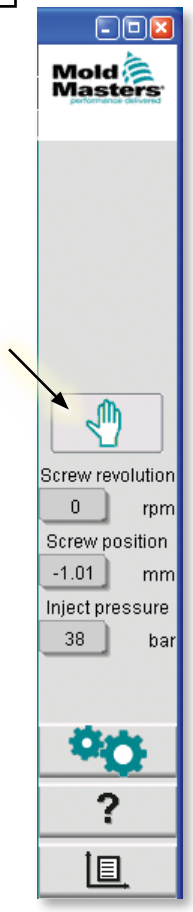


Element	Description
	Material Data can also be saved. Any parameters related to a specific material can be stored and retrieved at any time. See "*Screen Functionality Descriptions"* for more information.
	Machine Data can also be saved. Any parameters configured for the general operation of the E-Multi can be stored and retrieved at any time. See "*Screen Functionality Descriptions"* for more information. Note: Be careful never to load the wrong mold, material or machine data. Unexpected operation may result!
	Alarm Display. This button will display the alarm screen. The alarm screen displays a list of alarms triggered by the control system. See *"Troubleshooting the Control System" on page 11-1.*
	Previous screen. This button will take the user to the last screen that was displayed. It is a quick way of navigating through the screens.

Running Icon Description

These icons are displayed on the side bar while the E-Multi is operating.
They are displayed above the operation mode icon.
These icons give the user valuable information on the current status of the E-Multi.

Element	Description
	Screw is injecting
	Screw is holding
	Screw is rotating (Plasticizing)
	Screw is moving backward
	Screw is moving forward
	Nozzle is moving forward
	Nozzle is moving backward



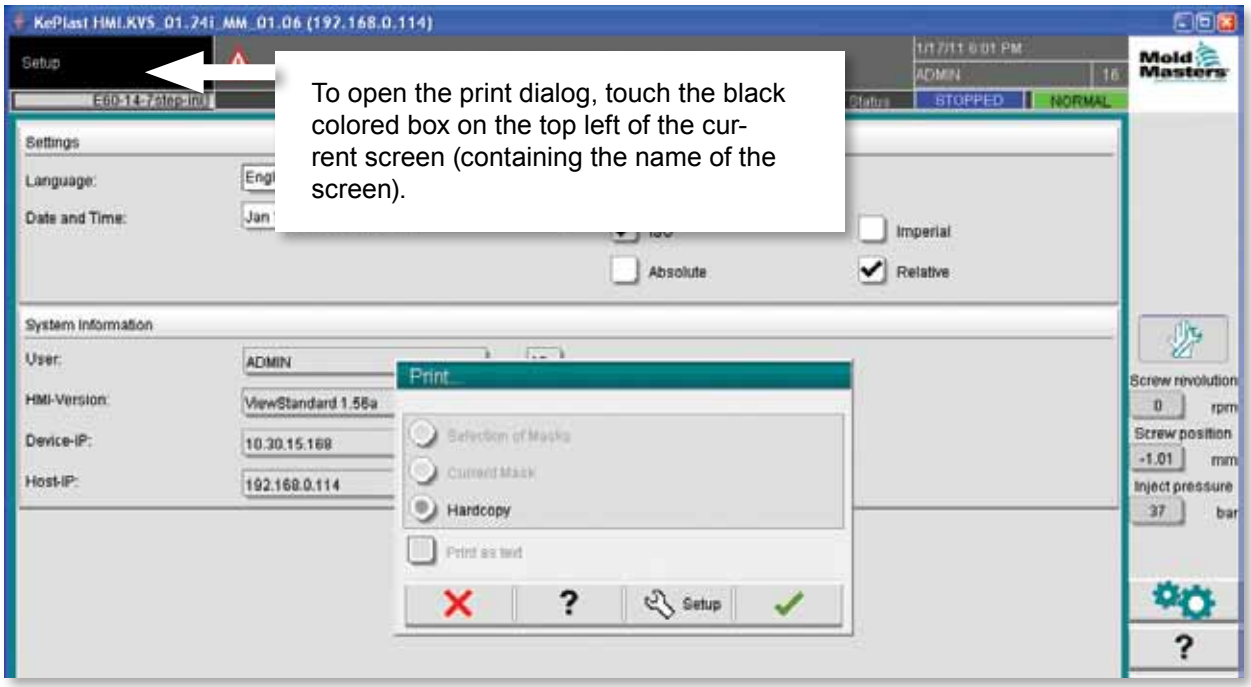
Screen Navigation Button Bar

At the bottom of each screen is a group of buttons that allows the user to navigate through the various HMI screens.

Below is a brief description of the various HMI screen buttons. For greater detail see the "*Screen Functionality Description*" of each screen in the following pages.

Element	Description
	**Overview Screen** This screen is the main screen for the system and displays data that gives a good overview of the operation of the E-Multi.
	**Drive Info Screen** This screen displays status and temperature values for the Injection and Plasticize servo motors.
	**Injection Screen** This screen is used to adjust the settings for the screw movement during injection and the switchover point.
	**Hold Screen** Holding pressure settings may be adjusted on this screen.
	**Plasticize and Decompression Screen** This screen is used to adjust the settings for plasticizing and decompressing.
	**Carriage (Nozzle) Screen** Carriage movement settings may be adjusted from this screen.
	**Temperatures Screen** The temperature settings for the heater can be entered in this screen.
	**Injection Graphics Screen** The Injection Graphics screen is used for measurement and display of preset system variables.
	**Machine Specification Screen** This screen serves as a central access point for all configuration screens as well as service and maintenance screens.
	**Euromap 67** This screen allows the user to monitor the hard wired I/O that is between the molding machine, E-Multi and the robot. (See also *"Appendix A - Euromap 67" on page A-i)*.

Print Functionality

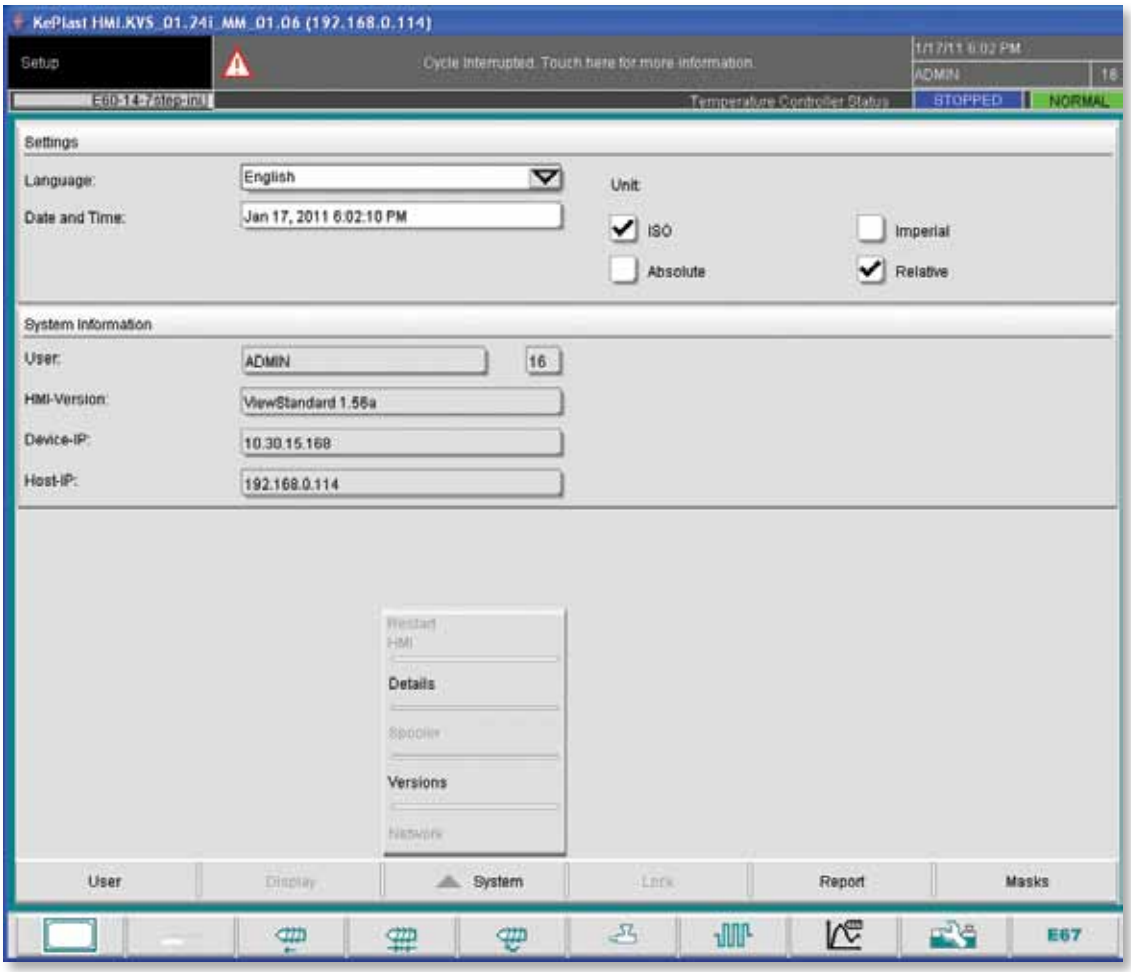


When you click on the “Setup” button, the set up screen on the right will open. The printer settings are described below.

Printer Settings	
Screen Element	**Description**
Use Printer	Output to a USB printer.
Print to File	Output to a file.
MIME Type	Selection of a MIME-type for the output file.
Directory	Target directory for the output file.
Filename	File name of the output file.

Screen Functionality Descriptions

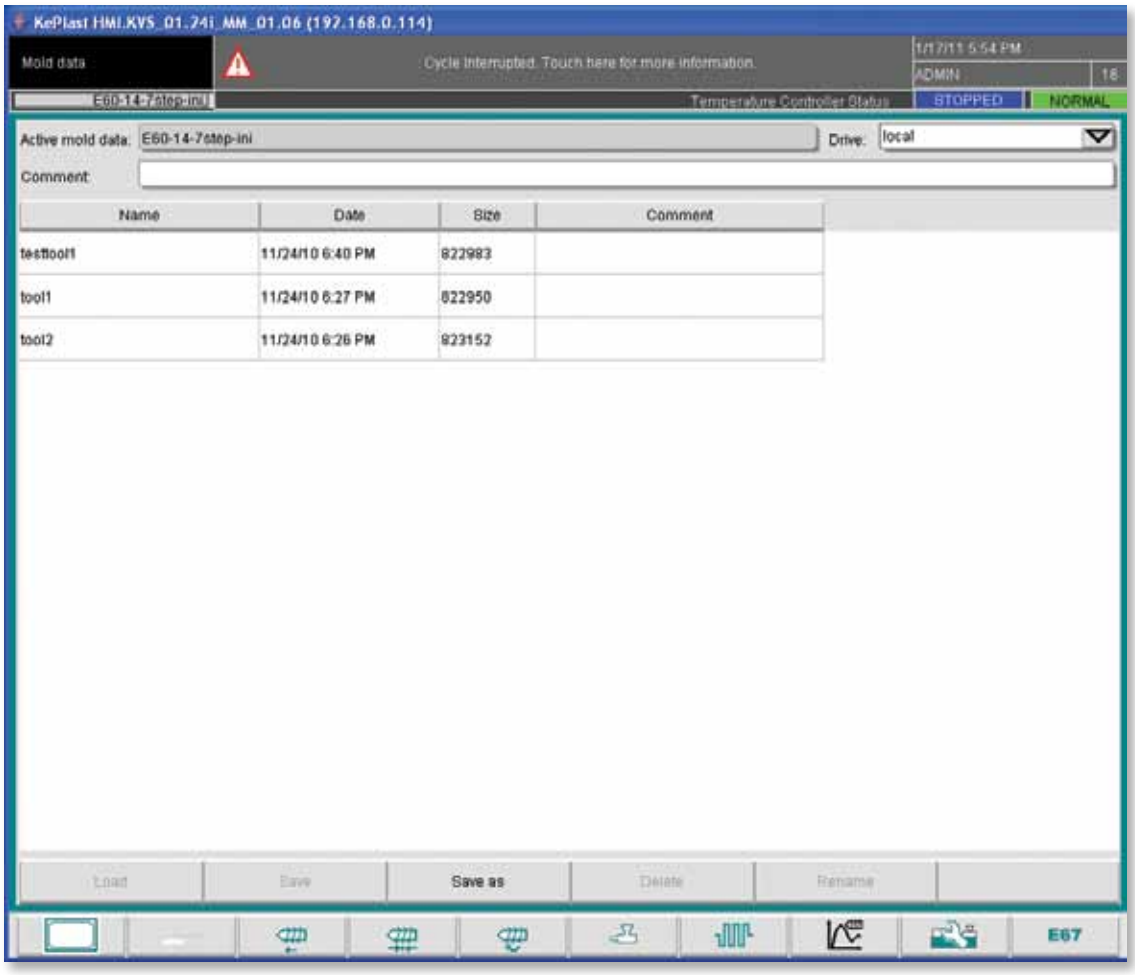
System Set Up



Purpose	
The setup screen is used to adjust the display of system information.	
Description of the screen	
Used to select display language and units of measure, as well as settings for the local date and time. System information is displayed, but not changed, on this screen. Other functions of the setup screen can be invoked via the setup menu buttons.	
Screen Element	**Description**
Language	Used to select a system language from those available.
Date and time	The system time and the current date of the controller can be set here. These are centrally managed and saved on the controller.
Unit	Allows the user to select a unit of measure for displaying information on the controller (Imperial, Relative, Absolute, etc.).

System Information	
User	Shows the name of the user that is logged in and the access level of the user (1-16).
HMI Version	Shows the current version of the Kemro.view.standard runtime system (format: Vxx.yy).
Device IP	Shows the IP address of the HMI computer
Host IP	Shows the IP address of the controller.
Buttons	
User	Opens the login dialog and/or the user administration.
Display	Set brightness and contrast of the Handheld HMI display (only on Handheld HMI and HMI)
System This button is used to access additional menu buttons which are described on the right.	*Restart HMI* Restarts the HMI *Details* This menu entry can be used to display the dialog box for further system information. *OK*: Confirmation button for closing the dialog. *System*: Shows an overview of the configuration settings of the visualization and the start-up times of the loaded screens. *SysVars*: Shows an overview of the system variables the system is communicating with. *Update*: Refreshes the display. *Logfile*: Saves the overview of the communicating system variables in the file hmi.log (normally in the root directory of the system drive). *Spooler* Opens the spooler dialog and shows all pending print jobs (only under VxWorks). *Versions* This dialog shows the system and application versions for the control and the visualization. *Network* Opens the dialog for setting and displaying the network configuration. This option is only available on the OF45x and on Handheld HMI.
Lock	Locks and releases the touch screen operation (only for Handheld HMI and HMI)
Report	Pressing this button on a local station opens a file selection dialog, in which the status report can be saved on a drive with a specified name. The drives and directories which are available can be specified in the HMI configuration. Pressing the status report button on a remote station will store the status report in the root directory of the system drive of the controller. The status report contains the following information: - PMA stack (up to 4 files) - HMI event trace (key presses) - Boot log (optional) - System catalog - Info log - Current PCB configuration - Task analysis (WVR file) - Status report info file - Network status - KNet status - KNet error - Performance log
Screens	Used to switch to other application screens. The screen options are specified in the HMI configuration. Switch to a screen by selecting it in the dialog and pressing the confirmation button.

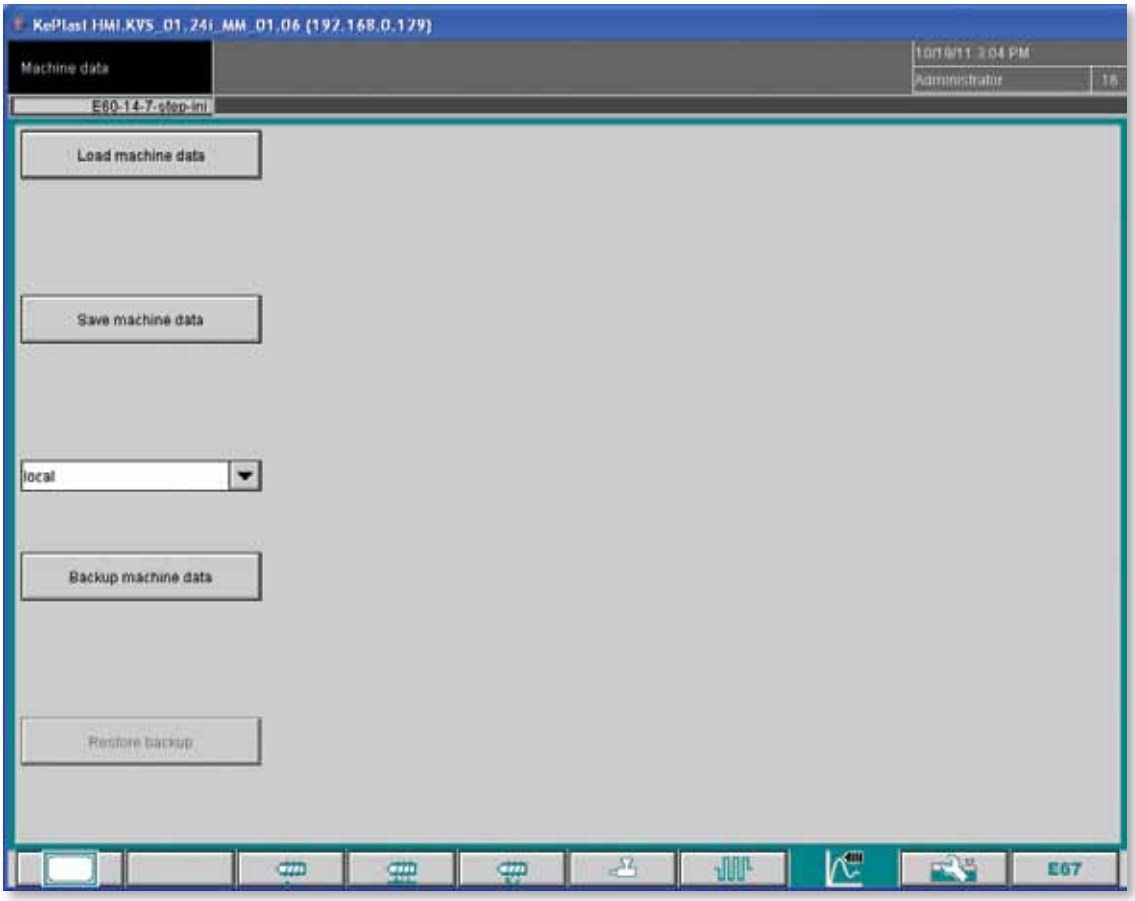
Mold Data



Purpose	
Mold-specific settings (e.g. all process data such as movement settings, profiles, temperature set points) can be stored and uploaded again as material data records in the component data screen.	
Description of the screen	
The upper section contains a table that can be used to show and/or select all previously created mold data records. A mold data record contains the settings for profiles, temperatures, mold height, etc. New mold data records can be changed via the menu bar, while existing records can be edited or deleted.	
Settings	
Screen Element	**Description**
Active mold data	Currently loaded component data record.
Drive	Selection of a drive (local compact flash or USB stick) for saving and loading the data set.
Comment	Comments about the current data set.
Name	Designation of the component data record.
Date	Creation date of the component data record.

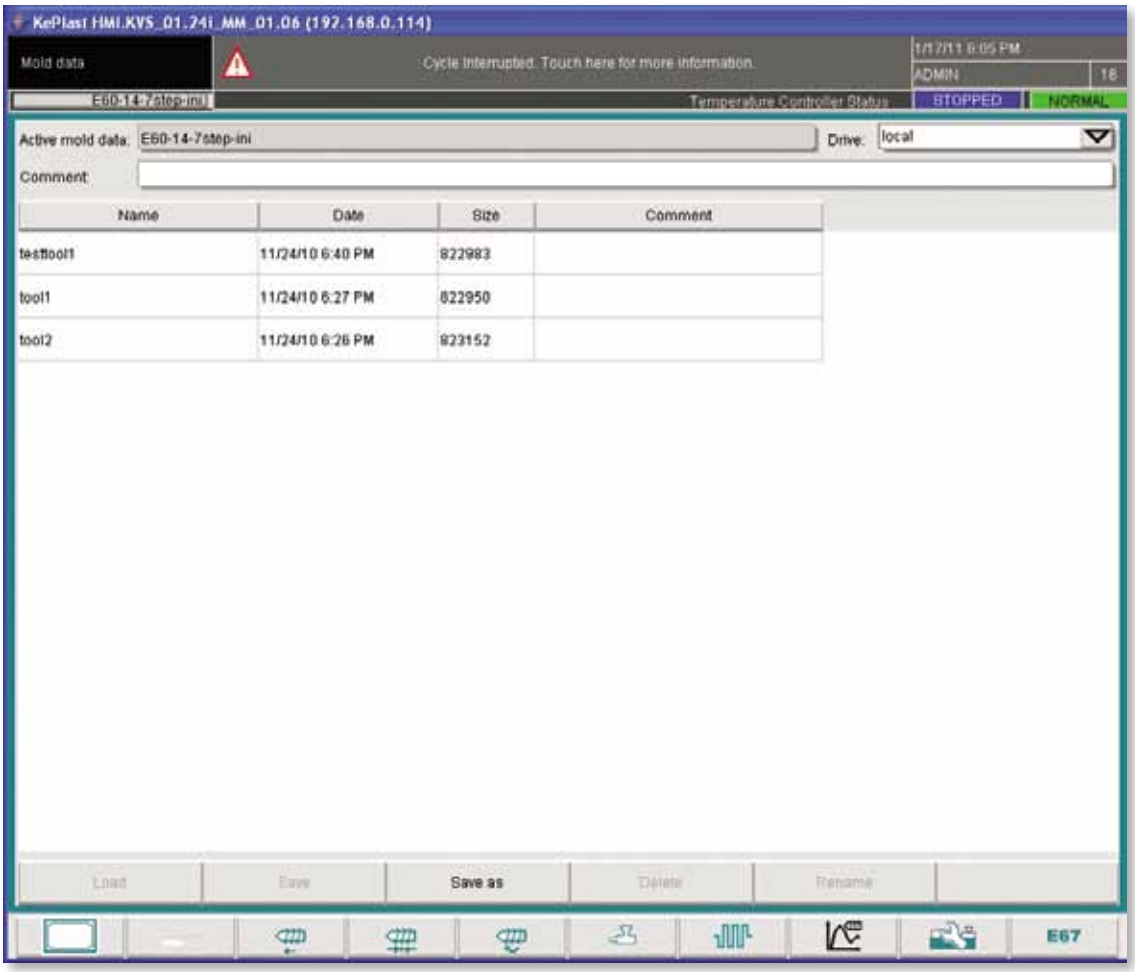
Screen Element	Description
Size	File size of the component data record.
Comment	Comments about the mold data set.
Load	Loads the settings of the selected component data record.
Save	Saves the settings of the component data record that was newly created and/ or which is currently loaded.
Save as	Saves the settings of the component data record that was newly created and/ or which is currently loaded under the name specified.
Delete	Deletes the selected component data record.
Rename	Renames the selected component data record.

Machine Data



Purpose
Machine specific settings, such as the number of heating zones, drive type, mold height adjustment, maximum injection velocity may be loaded and saved in the Machine Data screen.

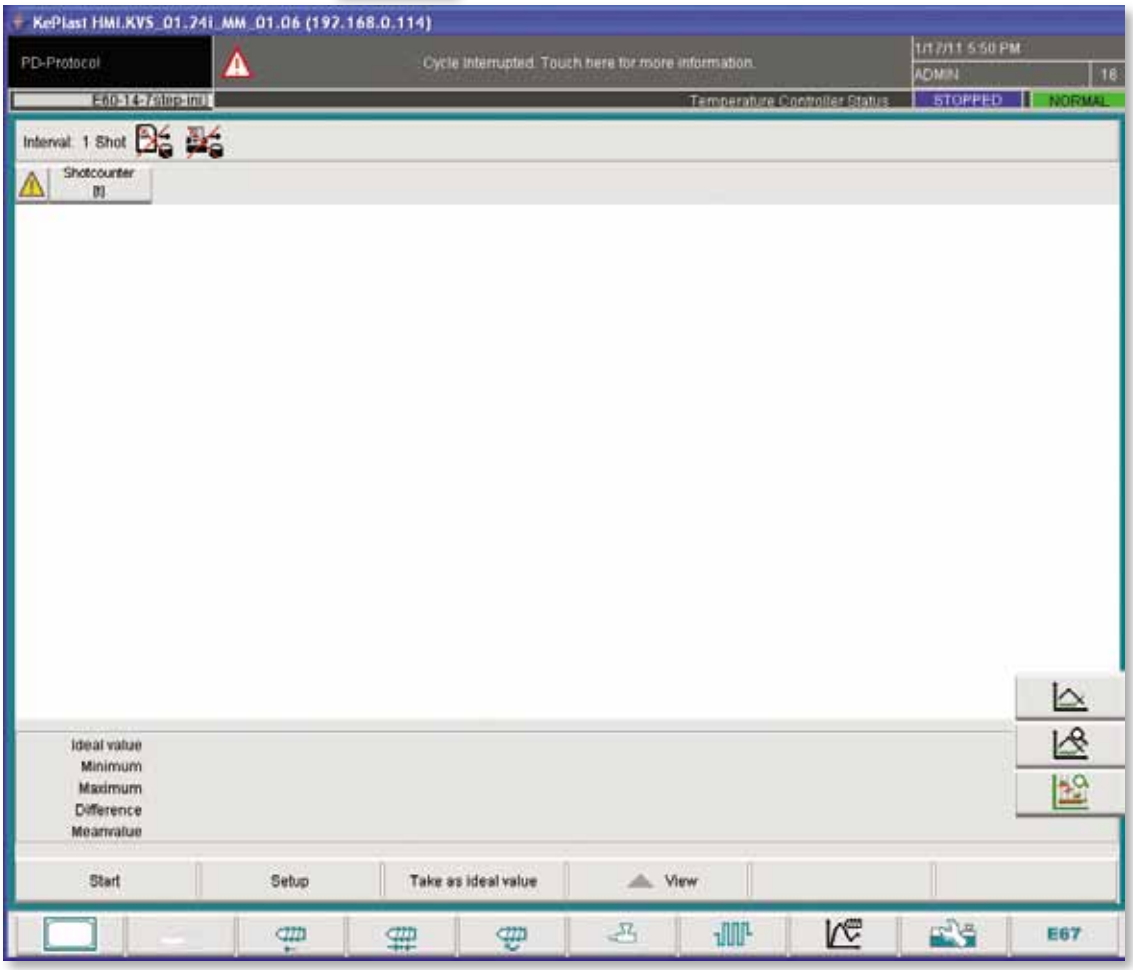
Material Data



Purpose	
Material related settings (such as temperature set points, lowering temperature, tolerance temperature, etc.) can be saved and uploaded in the material data screen.	
Description of the screen	
The upper section contains a table that can be used to show and/or select all previously created material data records. New material data records can be changed via the menu bar, while existing records can be edited or deleted.	
Screen Element	**Description**
Active material data	Shows the name of the material data record that is currently loaded.
Drive	Selection of a drive (local compact flash or USB stick) for saving and loading.
Comment	Comments about the currently loaded material data set.
Name	Designation of the material data record.
Date	Creation date of the material data record.
Size	File size of the material data record.
Comment	Comments about the material data set.

Screen Buttons	Description
Load	Loads the settings of the selected material data record.
Save	Saves the settings of the material data record that was newly created and/or which is currently loaded.
Save as	Saves the settings of the material data record that was newly created and/or which is currently loaded under the name specified.
Delete	Removes the selected material data record.
Rename	Renames the selected material data record.

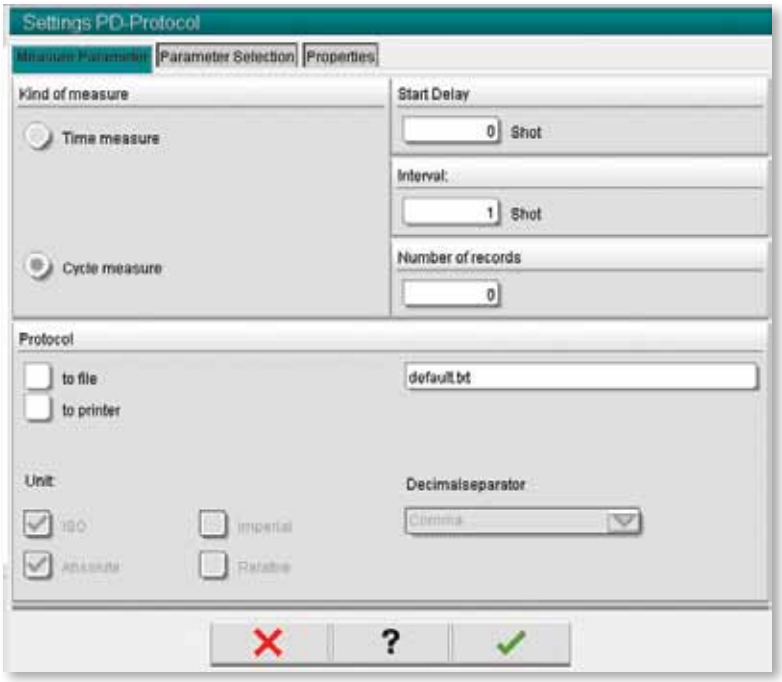
PD-Protocol Screen



Purpose
The process data protocol (PDP) screen serves to show process data in tabular form. The recorded values can be printed out during measurement or saved to a file.
Description of the screen
The recorded system variables are shown in a table. The number of process values is arbitrary. The table can be scrolled horizontally and vertically. The color scheme of the individual columns can be selected in PDP setup. The lower part of the screen shows the reference value, minimum, maximum and the difference between the two values, as well as the mean value for each process value. The number of cycles (injections) that are taken into account can be adjusted (the default is 20 injections).

Screen Buttons	Description
Start / stop	Starts / stops the measurement of process data. The button is displayed alternatively depending on the current status of the measurement.
Setup	Opens the settings dialog of the PDP protocol. See "*PD-Protocol Screen Settings*".
Take as reference	The values of the current measurement are set as reference values. Further measurements can be compared with these values.
View	*Details off*: This option is used to show and/or hide the status line at the upper edge of the screen. *Delete*: Deletes the displayed list. *Keep list / clear list*: Stops or starts the display of new values. The protocol log continues to run in the background. A renewed actuation of the button continues the display on the position of the current measurement.

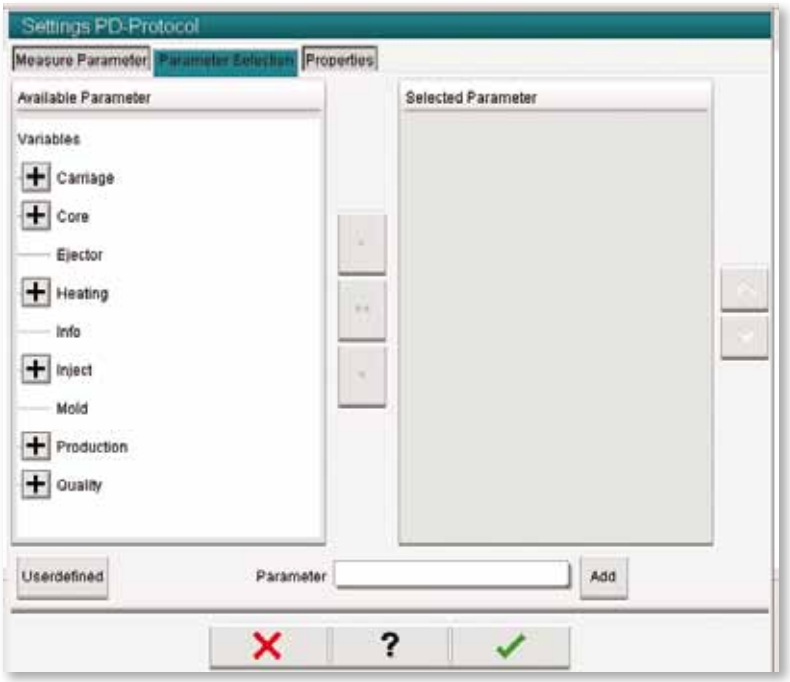
PD-Protocol Screen Settings



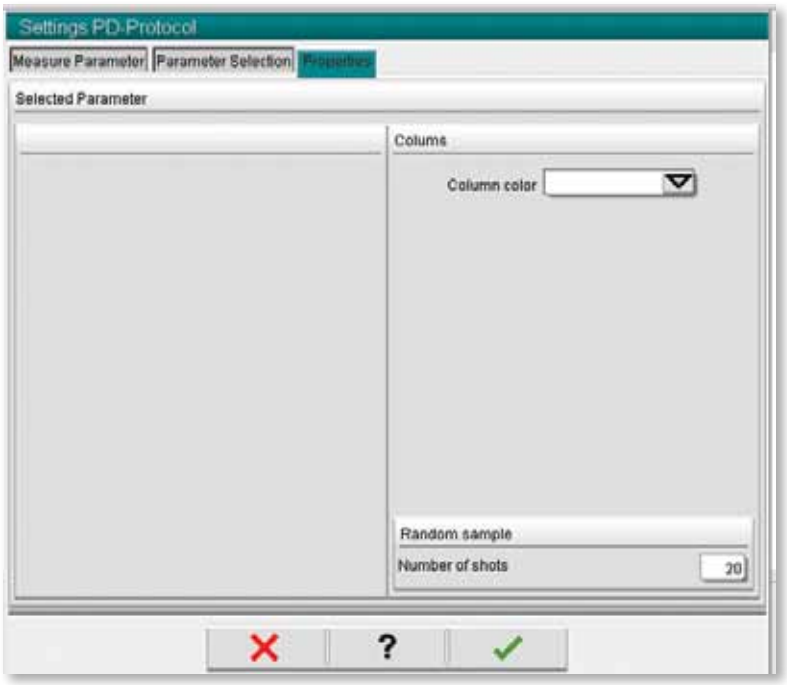
Description of the screen
The setup button in the PD-Protocol screen opens the settings dialog. There are three tabs: Measure Parameter, Parameter Selection and Properties. The various setting options are described in detail below.
Settings - Measure Parameter Tab
The measurement and output of the protocol can be adjusted in this section.

Input Field	Description
Time measure	When this measurement type is selected the measurement is made at the time intervals set in *Interval*.
Cycle measure	When this measurement type is selected the measurement is made after each number of shots (number of machine cycles) predefined in *Interval*.

Input Field	Description
Start delay	Delay between the activation of the start button and the actual start of measurement. For time measurement the specification is made in seconds, and for cycle measurement according to the number of injections.
Interval	Specifies measurement interval. For time measurements, the specification is made in seconds (minimum), and for cycle measurements, according to the number of shots.
Number of records	Number of measurement points (e.g. events = 10 means that exactly 10 values per variable are recorded).
to file (check box)	If activated, the protocol is simultaneously saved to a file. This parameter can also be modified at runtime of the measurement.
to file (input field)	File name of the protocol file.
to printer	If activated, the protocol is simultaneously saved to a printer. A printer dialog opens.
Error action	The selection of an action which is executed when an error occurs. This field can only be modified if output to file is activated.
ISO / Imperial	Specification of the unit system for the protocol. The system wide selected unit system is not affected by this setting. This field can only be modified if output to file is activated.
Absolute / Relative	Specification of the number representation for the protocol. The system wide selected number representation is not affected by this setting. This field can only be modified if output to file is activated.
Decimal separator	The selection of the decimal separator that is used for the output is made here. *Default*: The default separator of the system is used. *Period*: A period ('.') is used as separator. *Comma*: A comma (',') is used as separator. This field can only be modified if output to file is activated.

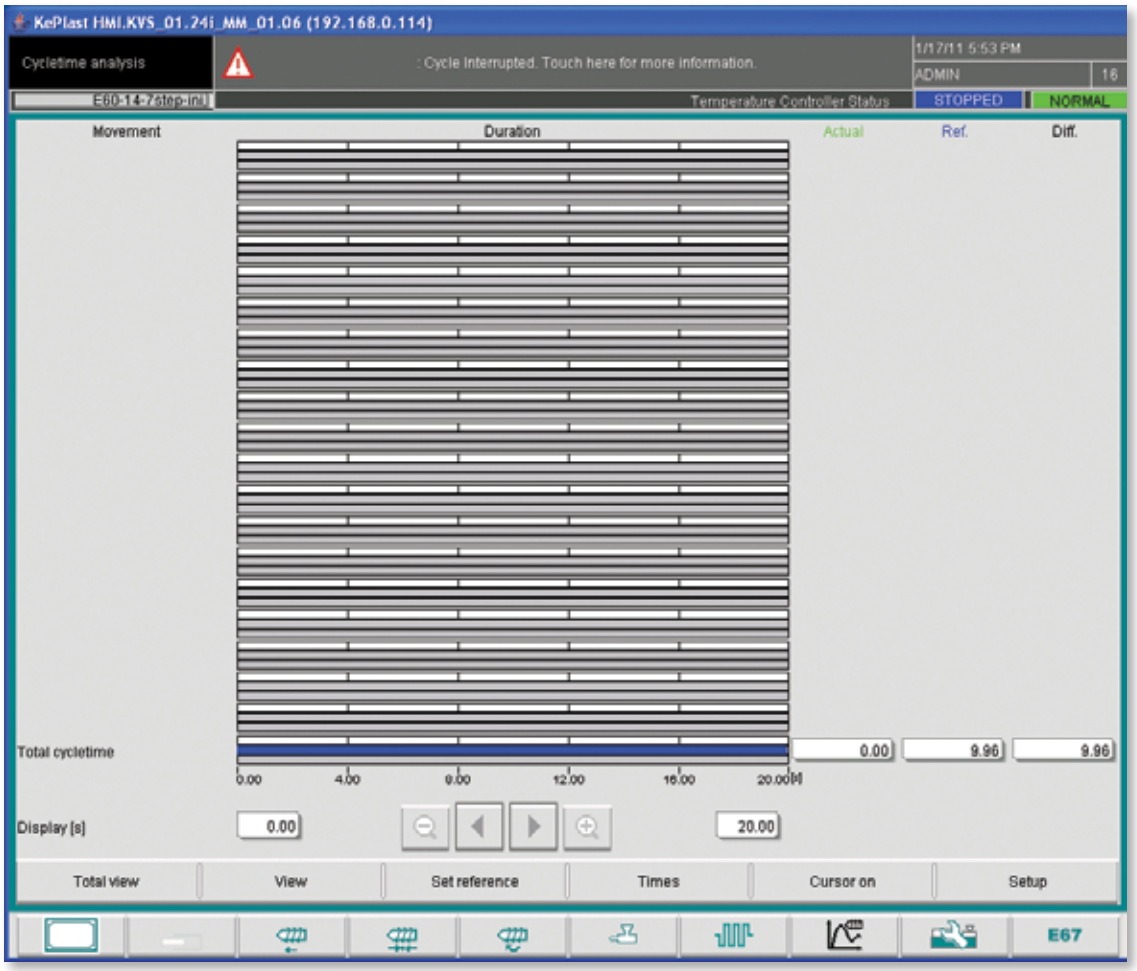


Settings – Parameter Selection Tab	
The system variables to be recorded can be selected from a list.	
Button / Input Field	**Description**
Available parameters	List of available system variables.
Parameter Selection	List of the system parameters selected for the protocol. > / << / < Moves the parameters in the direction specified.
User-defined	Opens the dialog for the creation of a user-defined group of system variables.
Parameter	Direct entry of a system variable via the keyboard. If the keyboard is displayed, a variable designation from the clipboard can be inserted with the appropriate button (a variable designation can be copied from the IO-monitor to the clipboard, for example).
Add	Inserts the selected system variable to the list of selected parameters.



Settings – Properties Tab	
A background color can be assigned to the individual columns of the protocol table on this page.	
Field	**Description**
Selected Parameter	List of the system parameters selected for the protocol.
Column color	The table column of the parameter selected is displayed with this background color. The colors to be selected are specified in the HMI configuration.
Number of shots	The number injections that should be used for determining the sample values (minimum, maximum, difference). By default, the last 20 injections are used.

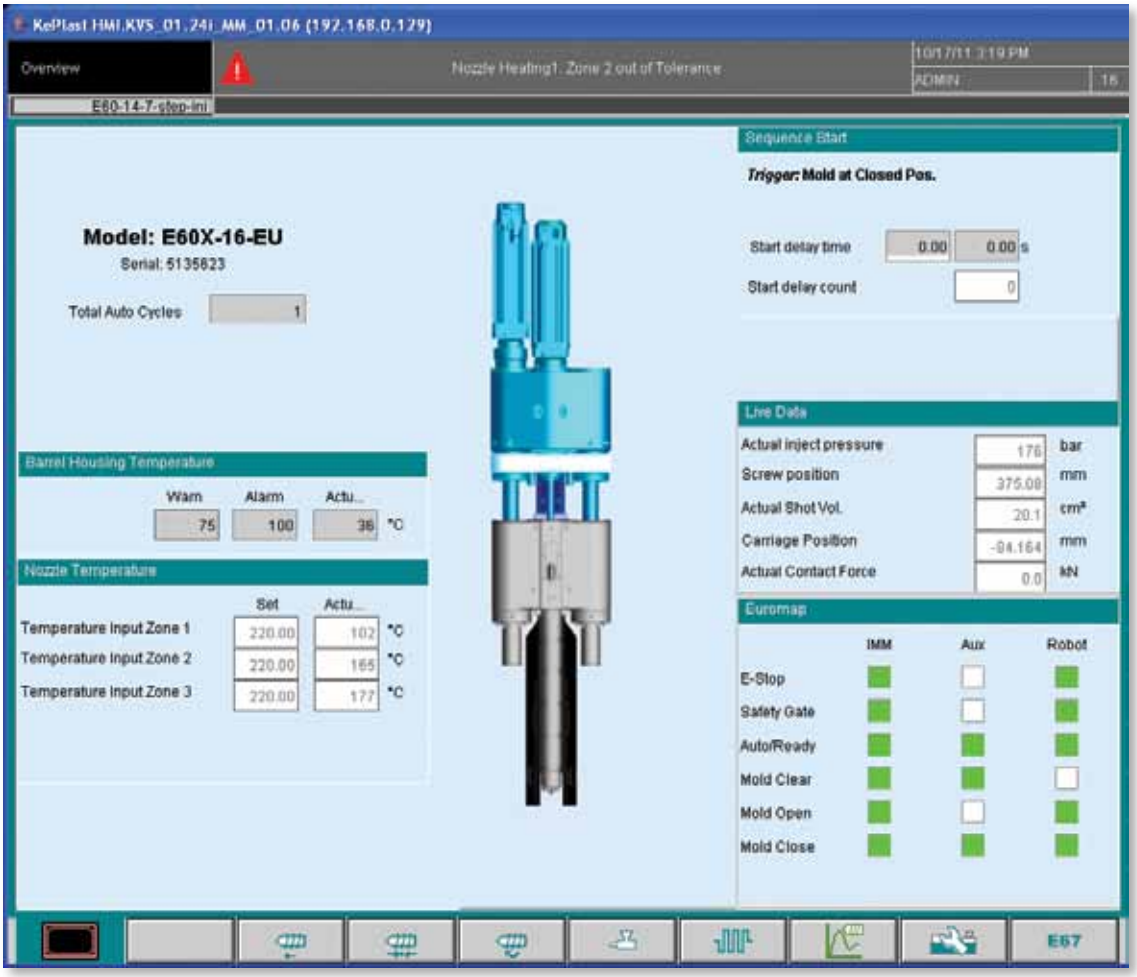
PD-Cycle Time Analysis Screen



Purpose	
This screen supports optimization of the machine setup over the total period of a production cycle. This provides an overview of selected movements which start at a particular time as well as an overview of their duration.	
Description of the screen	
The screen shows the starting and running times of selected movements in the form of a bar graph and as numerical values in an adjacent table. The time window starts with a 0 at the start of a production cycle and ends with the last movement. The time is displayed in seconds. The buttons are used to show various values on the display. Movements that are to be displayed are selected in the setup screen. The bar can be arranged after the initial run. The processes are sorted in ascending order according to their start time.	
Bar graph	**Two horizontal bars are displayed for each movement.**
Upper bar, in blue color.	Comparative value, option: The last cycle: 1) a previously stored reference cycle or 2) entered limit values.
Lower bar, in green or red color.	Current, last movement.Green bar: Movement within limit values. Red bar: Movement has exceeded limit values.
As soon as a movement starts, the bar of the current cycle grows on the time axis until the movement stops. If a movement exceeds a set limit or tolerance value of the compared reference curve, the bar turns red. No other action is triggered, however. Above the current bar a second value with the selected comparative value is displayed. The total cycle time is displayed as an additional bar at the bottom of the screen. The time axis is scaled so that it shows the total cycle time. It can also be scaled with the zoom function.	

<table>
<tr><th>Screen Elements</th><th>Description</th></tr>
<tr><td>Display of values</td><td>The times are shown in the form of a table next to the bar graph. A time or difference display can be selected. See Screen Buttons below - view and compare / times.</td></tr>
<tr><td>Cursor and zoom function</td><td>A cursor can be faded in and moved via touch screen or with the arrow keys. The values at the current cursor position are shown in the value display.
The zoom function can be used to change the time sector displayed in the window in stages. The button Total view switches back to the view of the total cycle.</td></tr>
<tr><th>Screen Buttons</th><th>Description</th></tr>
<tr><td>Total view</td><td>Clears the zoom function and switches back to the display of the total production cycle.</td></tr>
<tr><td>View</td><td>Selection of comparative values in the bar and value display. Can only be selected in the comparison display. The selected view is also used for the comparison bar in the bar graph.
<table>
<tr><th>Elements</th><th>Description</th></tr>
<tr><td>Last cycle</td><td>Comparative values of last cycle.</td></tr>
<tr><td>Reference cycle</td><td>Values of the previously stored reference cycle.</td></tr>
<tr><td>Limit values</td><td>Set limit values.</td></tr>
</table></td></tr>
<tr><td>Set reference</td><td>The last complete cycle is stored as a reference for future comparison.</td></tr>
<tr><td>Compare / Times</td><td>Selection of the display mode for the value display.
Times: Display of start, end and duration of movement.
Comparison: Display of the current movement duration, of the comparison value (last cycle, reference value or limit value) selected in the display, and the difference between both. The limit values can be set in the screen. User permission >10 is required for setting the values.</td></tr>
<tr><td>Cursor on / off</td><td>Fading in of a cursor for selecting the displayed values.</td></tr>
<tr><td>Setup
  </td><td>Opens a cycle time setup window.
<table>
<tr><th>Elements</th><th>Description</th></tr>
<tr><td>Movements & Selected Parameters Lists</td><td>Movements can be selected and transferred to the selected parameters list.</td></tr>
<tr><td>Tolerance Reference Cycle</td><td>Settable tolerance from which a deviation of the current cycle from the reference value is displayed by the color of the bar turning to red.</td></tr>
<tr><td>Sort (Start time)</td><td>The movement is sorted according to start time, to better follow the sequence of movements visually.</td></tr>
</table></td></tr>
</table>

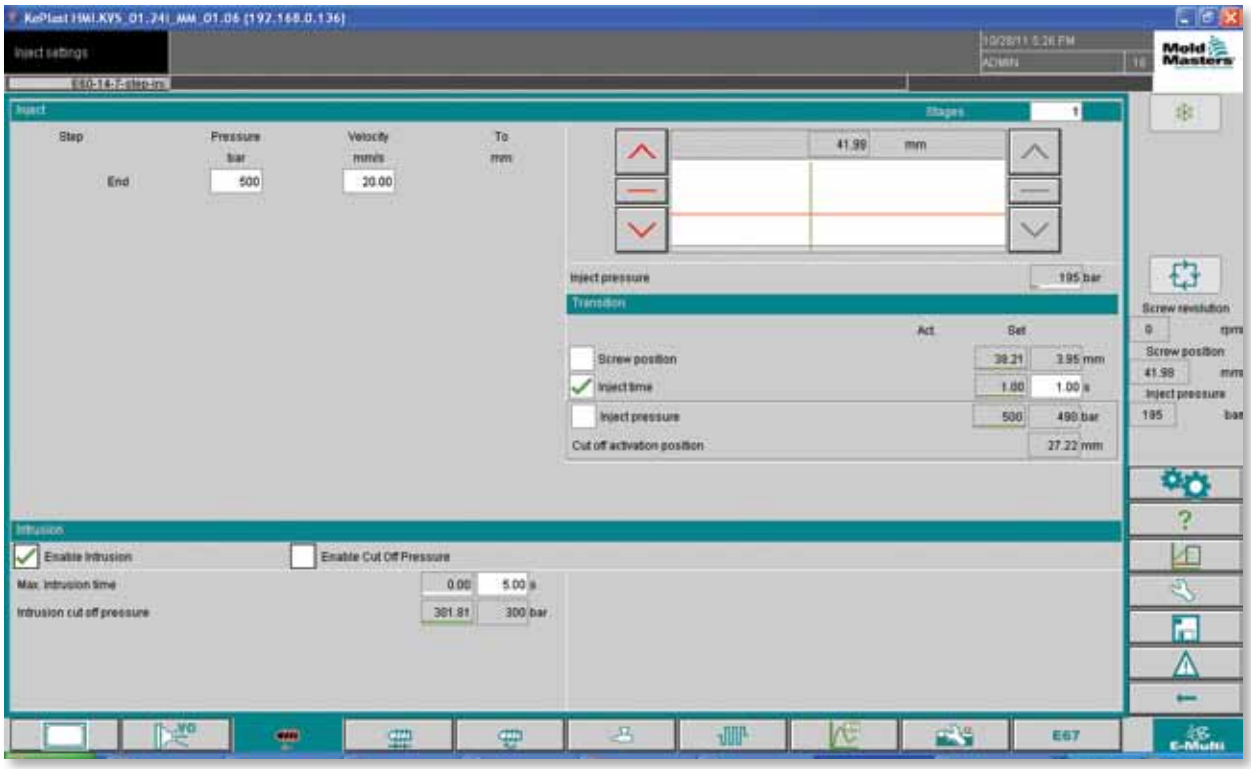
Overview Screen



Purpose	
This screen is the main screen for the system and displays data that gives a overview of the operation of the E-Multi.	
Screen Components	**Description**
Model and Serial Number	Model and serial numbers for the E-Multi. Use these numbers to reference your system when talking to *Mold-Masters* support personnel.
Live Temperature Zone Values	This section displays the actual and setpoint values for the heating zones. These values may be changed on the Temperatures Screen.
Sequence Start / Trigger	This window displays the current start trigger settings. The settings may be changed on the Euromap 67 screen. *Trigger:* This is the Euromap I/O signal from the molding machine that starts the E-Multi process. *Start Delay Time:* When the Euromap signal is detected, this time delay is added before the E-Multi process starts. Set to zero to disable.

Screen Components	Description
Live Data	This is a live display of some production variables. *Actual Injection Pressure*: This is the pressure currently produced by the injection process. *Screw Position:* This is current size of the shot. *Actual Shot Volume* *Carriage Position* *Actual Contact Force:* This is the force generated by the nozzle carriage.
Euromap (see Euromap 67 Appendix A)	This is a quick overview of the live status of the Euromap wiring. Red - signal is logical false Green - signal is logical true Grey - signal is not used

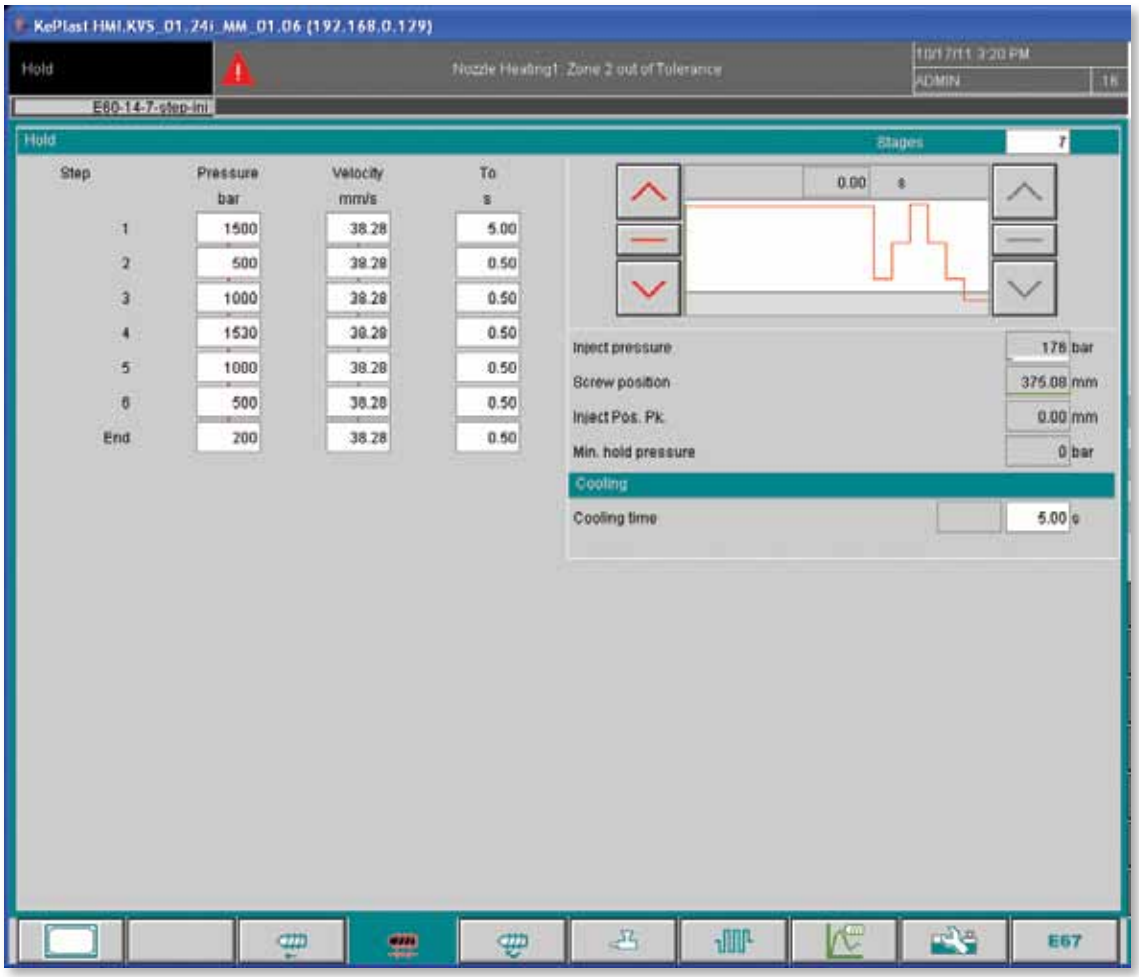
Injection Screen



Purpose
This screen is used to adjust the settings for the screw movement during injection and the switchover point.
Description of the screen
Besides the input fields, the pressure profiles (red) and the velocity profiles (grey) are shown in the form of curves. Besides entering the values directly into the fields, the pressure and velocity values can also be adjusted with the arrow keys next to the profile curves. For each click the profile curve is adjusted by +/-5 bar and/or +/-5%.A separate button is used to switch pressure and velocity to constant output.

<table>
<tr><th>Screen Elements</th><th colspan="2">Description</th></tr>
<tr><td>Stages</td><td colspan="2">Number of adjustable stages (maximum of 10).</td></tr>
<tr><td>1..n</td><td colspan="2">Setting the pressure (field: Pressure) and quantity (field: Velocity) between the end position of the previous stage (in the case of stage 1, screw position "Back end position") and the position specified under and during injection.</td></tr>
<tr><td>End</td><td colspan="2">Setting the pressure (field: Pressure) and quantity (field: Velocity) between the end position of the previous stage and the end position during injection.</td></tr>
<tr><td>Spec. inject pressure (optional)</td><td colspan="2">Displays the current specific injection pressure. This field is only shown if a corresponding sensor is available.</td></tr>
<tr><td rowspan="5">Switchover point</td><td colspan="2">The change-over point, at which the system changes from injection to hold pressure, can be adjusted in this section. When selecting more than one criterion, the system changes over to hold pressure as soon as one condition is met.</td></tr>
<tr><td>Elements</td><td>Description</td></tr>
<tr><td>Screw position</td><td>Specifies the screw position where the system changes to hold pressure. This criterion is activated by selecting the adjacent check box.</td></tr>
<tr><td>Inject time</td><td>Specifies the duration, measured from the start of the injection process, until the point when the system changes to hold pressure. This criterion is activated by selecting the adjacent check box.</td></tr>
<tr><td>Inject pressure (optional)</td><td>Specifies the injection pressure at which the system changes to hold pressure. This criterion is activated by selecting the adjacent check box. This field is only shown if a sensor is available for injection pressure.</td></tr>
<tr><td>Cut off activation position (optional)</td><td>Screw position at which the switch-over point detection is activated. This function avoids the erroneous actuation of the switch over point detection at the start of the injection.
This setting is only available when the injection pressure box is checked.</td></tr>
<tr><td>Intrusion</td><td colspan="2">Intrusion is used to pre-charge the manifold by plasticizing (running the screw) before injection.
When enabled, plasticizing will run for the “Intrusion time” before beginning injection.
Optionally, the user may also enable the Cutoff pressure, which will stop plasticizing if the “Intrusion Cut off Pressure” is reached before intrusion times out.</td></tr>
</table>

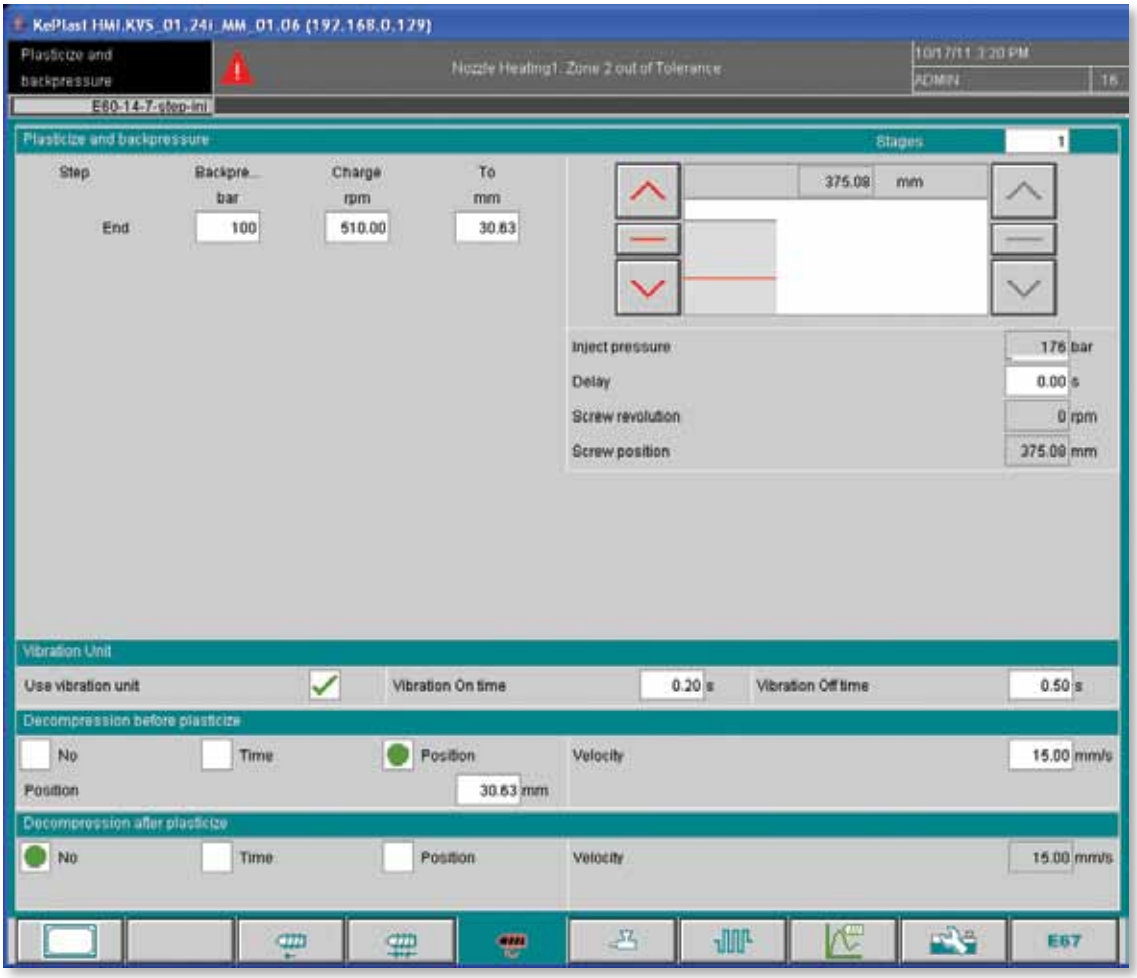
Hold Screen



Purpose	
This screen is used for adjusting holding pressure settings.	
Description of the screen	
Besides the input fields, the pressure profiles (red) and the velocity profiles (grey) are shown in the form of curves. The cooling time (duration of cooling after hold pressure) and the number of stages (time intervals) can be set here. Besides entering the values directly into the fields, the pressure and velocity values can also be adjusted with the arrow keys next to the profile curves. For each click the profile curve is adjusted by +/-5 bar and/or +/-5%. A separate button is used to switch pressure and velocity to constant output.	
Screen Elements	**Description**
Holding Pressure	
Stages	The number of stages (time intervals) can be adjusted here (maximum of 10).
1..n	Setting the *Pressure* and *Velocity* for the duration specified under *To* at hold pressure. The input field for *Velocity* is available only with electric machines. Depending on the number of stages, additional input fields are shown here to adjust the stages (2,3,...n). These settings always apply for the time intervals between the end of the prior stage and the duration specified under *To*.

Screen Elements	Description
End	Setting the *Pressure* and *Velocity* between the prior stage and the final duration at hold pressure.
Spec. inject pressure (optional)	Displays the current specific injection pressure. This field is only shown if a corresponding sensor is available.
Screw position	Display of the current screw position.
Cooling	
Cooling Time	The current cooling time (actual value) is shown in the left field (grey). The cooling time (setpoint) can be entered into the right (white) field.

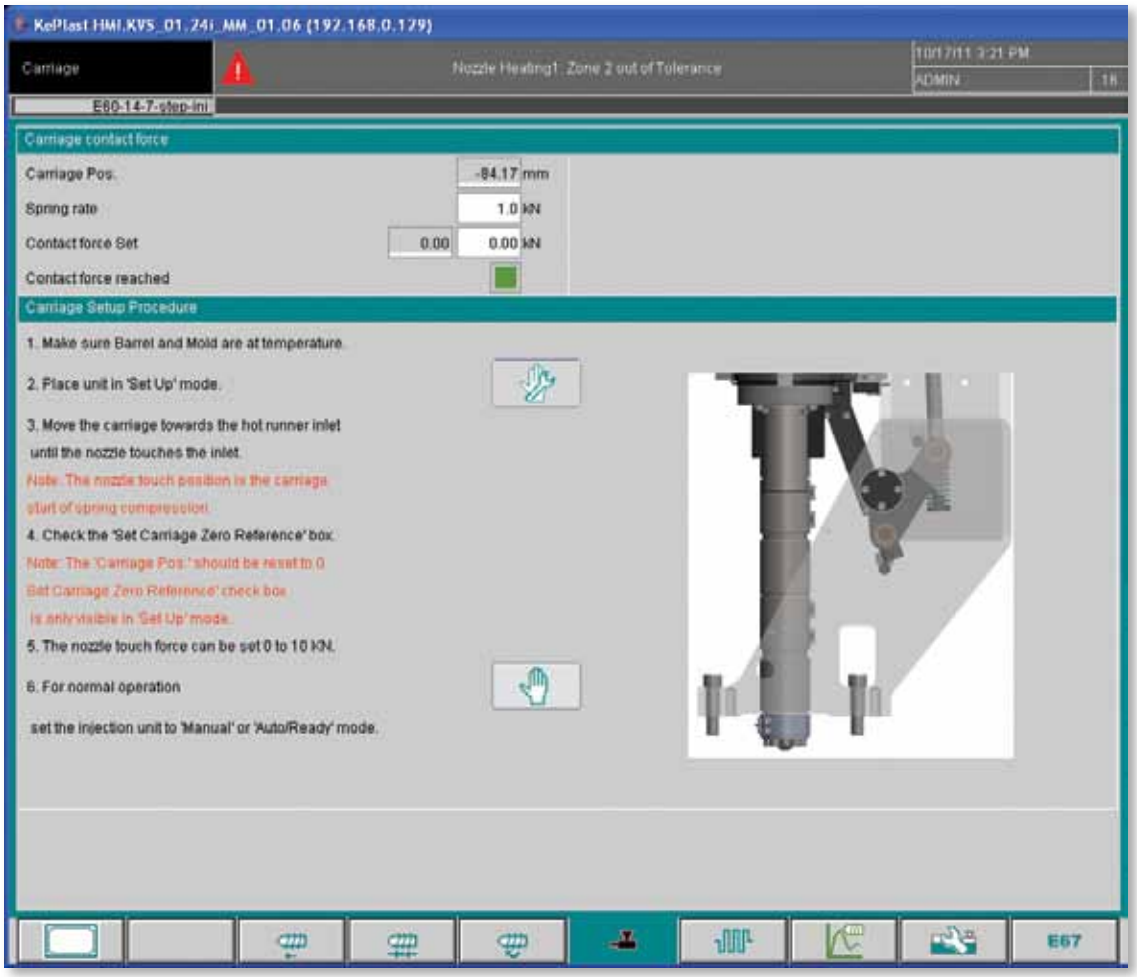
Plasticize and Decompression Screen



Purpose
This screen is used to adjust the settings for plasticizing and decompressing.
Description of the screen
The backpressure and screw feed speed for specific screw positions can be entered in the section *Plasticize and backpressure*. The values are shown in the form of curves to the right of the input fields. They can be changed with the arrow keys. In increments of 5 the back pressure is increased and/or decreased with the red keys while the grey keys are used for the screw feed speed. Additional input groups allow settings to be changed for *Decompression before plasticize* and *Decompression after plasticize*.

Screen Elements	Description
Plasticizing and back-pressure	
Stages	The number of stages (path sections) (maximum of 5).
1..n	Setting the Back pressure and RPM between the end position of the previous stage (in case of stage 1, the end position of the previous part movement) and the position specified under to at dosing.
End	Setting the Back pressure and RPM between the previous stage and the end position specified under until at dosing.
Inject Pressure	Injection pressure display.
Delay	Once the end position has been reached and the waiting time specified under "Delay Time" has passed, plasticizing starts.
Screw speed	Displays the current screw feed speed.
Screw position	Displays the current screw position.
Decompression before Plasticize	
These settings apply only for semi- and fully automatic mode. The settings made under "Decompressing after Plasticize" apply to manual mode.	
Mode	Mode of decompression before plasticizing, with the following selection options: *No*: no decompressing. *Time*: decompression for a specified time duration. *Position*: decompression until a specified screw position.
Position / Time	Specifies the screw position and/or the duration of the decompression. The display is dependent on the mode selected.
Velocity	Specifies of the velocity for the linear screw movement. This field can only be edited when 'Time' or 'Position' mode has been selected.
Decompression after Plasticize	
Mode	Mode of decompression after plasticizing, with the following options: *No*: no decompressing. *Time*: decompression for a specified time duration. *Position*: decompression until a specified screw position.
Position / time	Specification of the screw position (relative distance to position "Plasticizing end") and/or duration of decompression. The display is dependent on the mode selected.
Pressure	Specifies of the pressure for the linear screw movement. This field can only be edited when 'Time' or 'Position' mode has been selected.
Vibration Unit	
The vibrator is attached to the feed hopper or feed tube. Vibration can be used to help the flow of material into the feed block.	
Use Vibration Unit	Checking this box will enable the vibration unit. Unchecking the box will disable the vibration unit.
Vibration On Time	Specifies the amount of time the vibration is on within the off/on cycle.
Vibration Off Time	Specifies the amount of time the vibration is off within the off/on cycle.

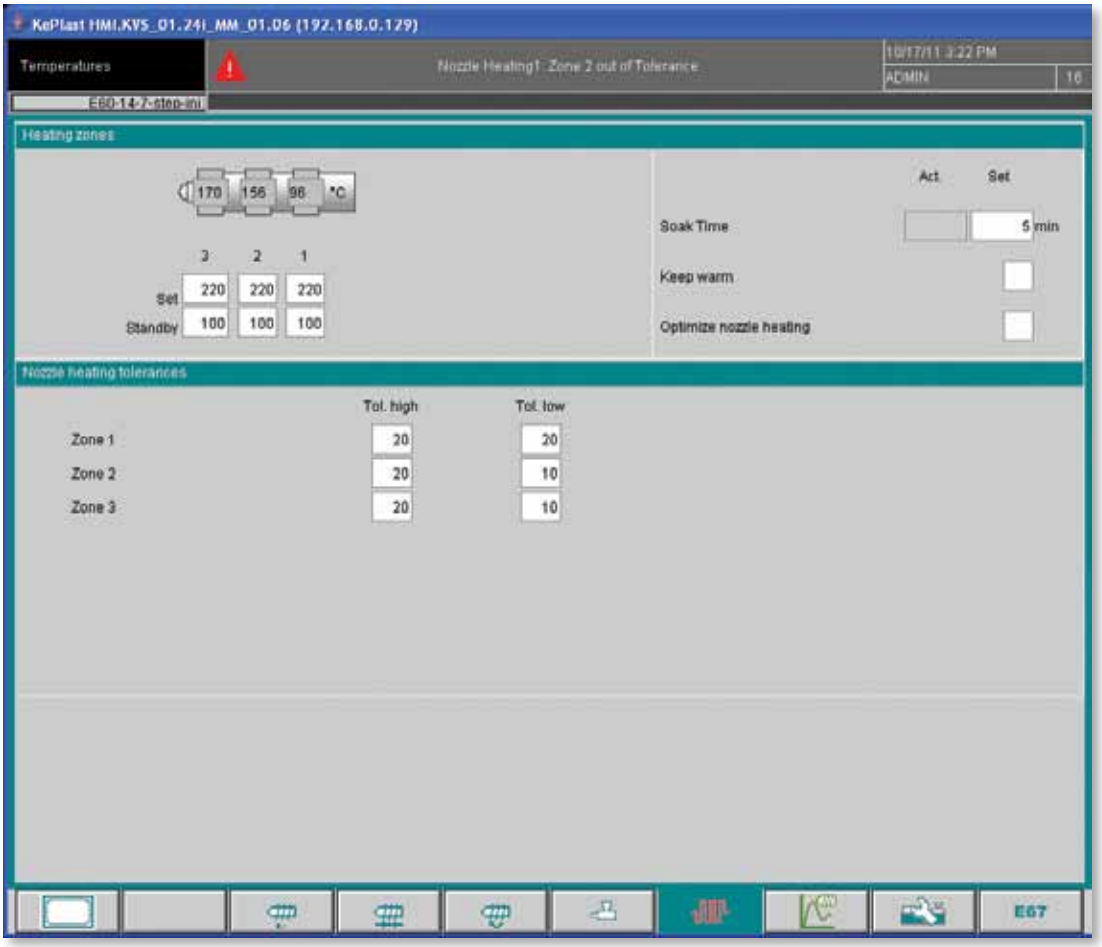
Carriage (Nozzle) Screen



Purpose	
Carriage movement settings may be adjusted from this screen.	
Description of the screen	
The carriage mode backward group allows selection of a carriage retract option. The pressure and quantity for specific carriage paths (levels) are specified in the groups carriage forward and carriage backward. Next to the input fields, the pressure profiles (red) and the velocity profiles (grey) are shown in the form of curves on machines with position sensors for the carriage.	
Screen Elements	**Description**
Carriage Mode Backward (Optional)	
No	Deactivate carriage retract. If this is selected the carriage doesn't move from the injection position.
After Plasticize	After plasticizing the carriage retracts to its end limit or for a specified time, depending of the selected carriage movement mode.
Before mold open	Before plasticizing the carriage retracts to its end limit or for a specified time, depending on the selected carriage movement mode.
After inject	After injection the carriage retracts to its end limit or for a specified time, depending on the selected carriage movement mode.

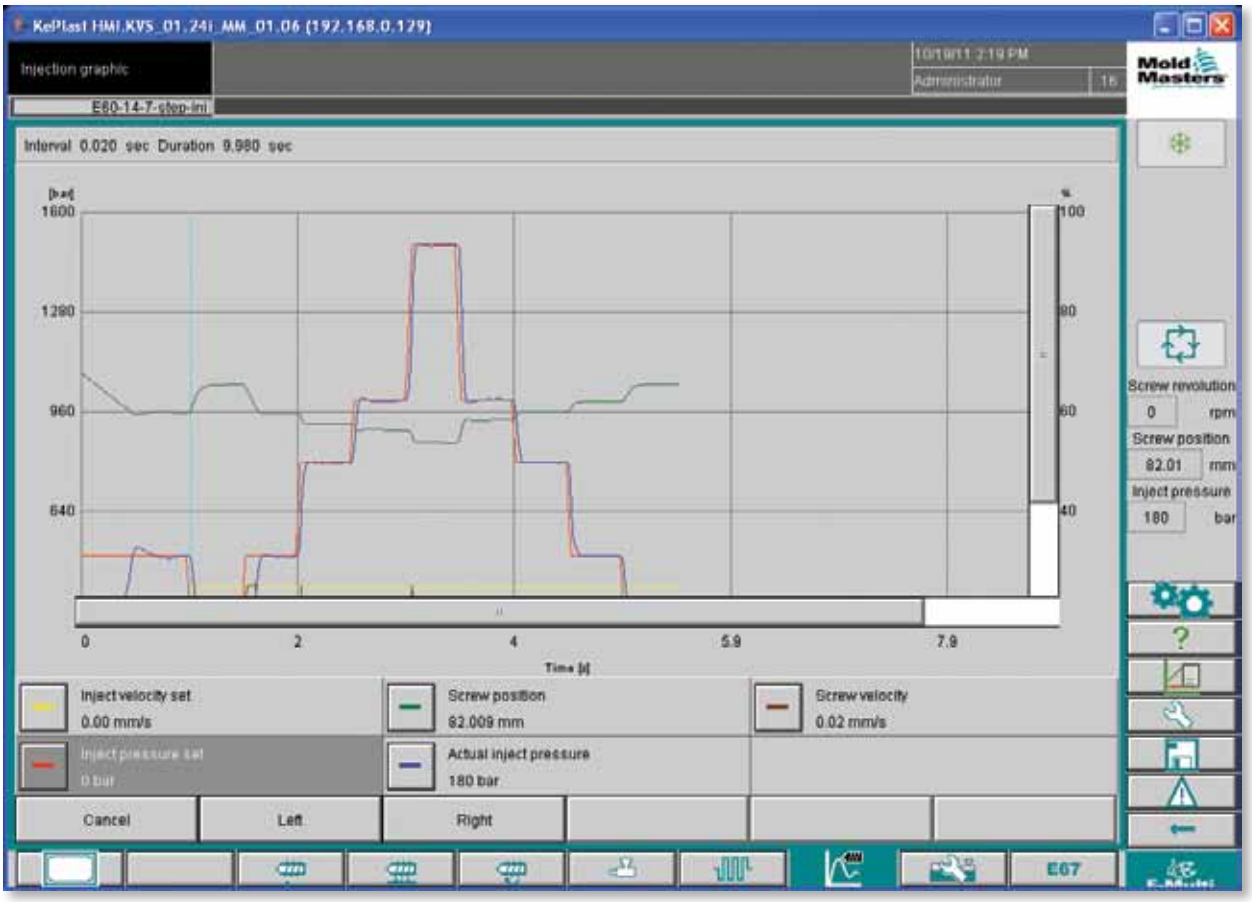
Carriage Backward (Optional)	
Rel. set pos Bwd	Used to scale the carriage movement. After jogging the carriage to the fully backward position set the Rel. set pos Bwd to zero mm.
Carriage Contact Force	
Carriage Position	Relative position of the nozzle to mold inlet.
Spring Rate	The nozzle contact force per unit compression of spring.
Contact Force Set	The contact force that the nozzle applies to the mold inlet.
Contact Force Reached	It is an indicator to acknowledge the nozzle contact force has reached the set point.

Temperatures Screen

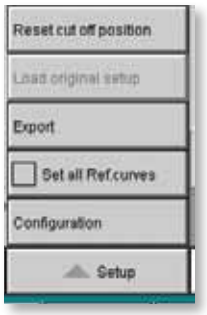
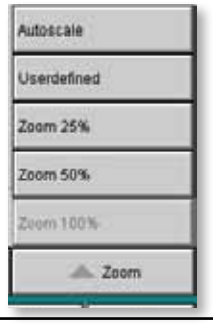


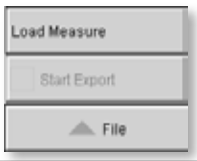
Purpose	
The temperature settings for the heater can be entered in this screen.	
Description of the screen	
The individual heating zones are graphically depicted in the heating zones section. The current temperature is shown in the middle of each heating zone. The input fields for the temperature setpoint and the standby temperature are located underneath the heating zones. Note: The display depends on the number of heating zones (see machine parameter screen "*Tab Genera*l")	
Heating zones	
Screen Elements	**Description**
Set	Specifies the temperature set-point value of the corresponding heating zone. Depending on the selected operating mode of the barrel heater, the specification is made in percentage of the maximum heating performance (operating mode "Setter") or in degrees (operating mode "PID").The operating mode of the barrel heater can be selected in the screen "Temperatures Screen".
Standby	Specifies the standby temperature of the corresponding heating zone (in degrees). The temperature is not lowered below this value. If this function is activated, the standby temperature is adopted as the new set-point value.
Temperatures	
Soak time	Specifies the waiting period until release of the screw movement, measured as of the moment when the temperatures of all heating zones are within a specific tolerance.
Keep warm	This function is used to hold the temperatures of the heating zones constantly above the lowering temperature. This setting is only effective with the operating mode "PID" of the screw heater.
Optimize nozzle heating	Pre-selection for optimizing all heating zones. The optimization itself is only started once this option has been selected and the heaters have been switched on.
Carriage Heating Mode	
Temp 1 - Temp x Set tolerances	Specifies the operating mode of the corresponding heating zone with the following setting options: Tol. high, Tol. low: Specifies the tolerance, within which the actual temperature of the heating zones must be (specification in degree). If this tolerance is exceeded an alarm will be triggered. Only when all zones are within the tolerance is movement of the screw possible.

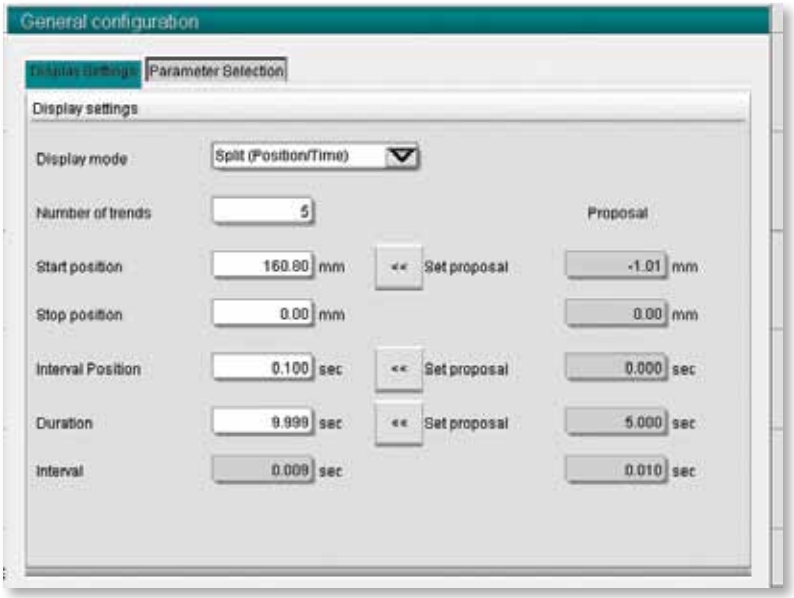
Injection Graphics Screen



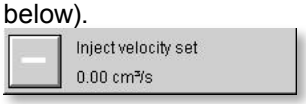
Purpose
The Injection Graphics screen is used for measurement and display of preset system variables.
Description of the screen
The recorded variables are shown as curves in a diagram. Measuring interval and measurement length (only for display type "Time") are shown above the diagram. The names and the current actual values of the variables are shown below the diagram. The following functions are possible: • Definition of reference curves. • Display of the last trend curve. • Monitoring using tolerance band. The change-over point, (the point at which the system changes from injection to hold pressure) is shown as a vertical line. The area between the maximum (latest) and minimum (earliest) change-over point is shown as a white bar at the upper edge of the diagram. In a properly set up process, this bar should be very narrow. The mean value of all change-over points to present is shown as a black line within the white bar. The display of the measured values curves occurs selectively in the following modes: • Time (y/t graph). • Position (y/x graph). • Split (mixed form, both diagram types).

Mode	Description
Time mode	In this display mode the x axis of the diagram corresponds to the duration of the injection process (injection and hold pressure).
Position mode	In this mode, the diagram is displayed position-dependently. The position values are shown on the x axis; the end value 0 mm is always located at the right edge. The measured values are recorded from the start of the injection process until reaching the change-over point.
Split mode	In this mode, two diagrams are displayed. The left diagram contains the position-dependent y/x graph of the injection phase. The measurement in this graph ends when the change-over point has been reached and is then continued on the right, time-dependent y/t graph for the hold pressure phase.
Menu Button	**Description**
Activate / Deactivate 	Activates / deactivates the measurement. The button label changes with the current status of the measurement.
Setup 	*Configuration*: Opens the General Configuration dialog. *See "Set-up Configuration Dialog"* table for further details. *Set all ref. curves*: This is used to select all displayed curves as reference curves. Pressing the button again cancels the selection of reference curves. *Export*: Opens the Export Settings dialog for the export of measurements. See "*Export Settings"* table for further details. *Load original setup*: If data from a file was loaded and displayed via the import function, this function can be returned to for the currently running measurement.
Menu Button	**Description**
Zoom 	*Zoom xxx%:* Enlarges the displayed area by the corresponding factor. *User defined*: An arbitrary area can be selected and then displayed magnified here. *Auto scale*: The x/y scales are automatically adapted to the optimum scaling.

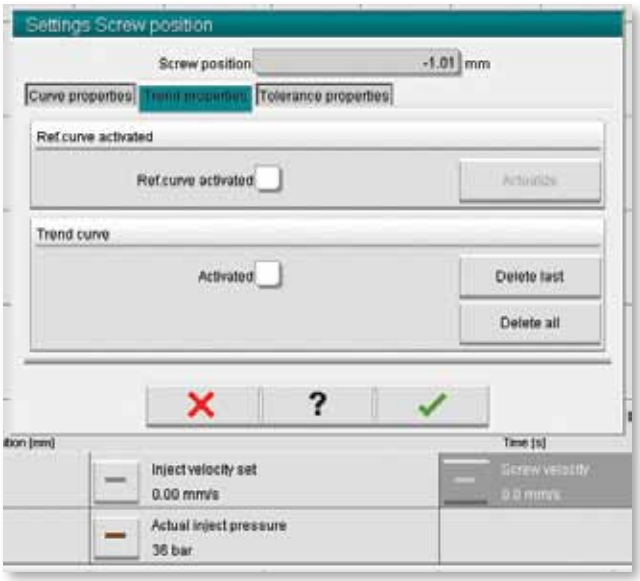
<table>
<tr><td>View
 
</td><td>Actual value:
Shows the actual value cursor (shown by a red cross per curve) that can be shifted using the position buttons (’Left’, ’Right’) to any position on the displayed curves. The measurement values at this position are displayed in the legend.
Pressing the “Cancel” button exits the dialog.
Maximize:
Enlarges or shrinks the displayed graph (display/hide legend).
Tol.band:
Activates or deactivates the display of the tolerance bands for all curves.
Trend:
Display / hide the trend display.
The previous curves are displayed simultaneously with the current curves in a slightly lighter color than the current curve. The number of curves to be displayed can be set in the settings dialog and is limited to 10 curves.
Reference:
Activates or deactivates the display of the reference curve for all curves.</td></tr>
<tr><td>Tolerance band
 
</td><td>Transfer:
Enables the transfer of curves into a monitoring range, inside which the curve is to move. The reference curve or the available trend curve can be referenced for every variable here as source.
A selection dialog is displayed in which a selection can be made whether the reference curve or the trend curves are used as source for the tolerance band. If the trend curve or reference curve are not available, the corresponding selection box is deactivated. The selection box is also deactivated if no matching "Tolerance properties" were entered.
<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>Name</td><td>Display of the available curves.</td></tr>
<tr><td>Ref.</td><td>If this field is activated, the tolerance band for the curve is transferred from the reference curve.This field is only available if a reference curve for the curve is saved.</td></tr>
<tr><td>Trend</td><td>If this field is activated, the tolerance band for the curve is transferred from the trend curve.This field is only available if trend curves for the curve are available.</td></tr>
</table></td></tr>
<tr><td>File
 
</td><td>Start Export:
Starts the export of the current curve.
Load Measurement:
Opens a saved measurement and shows the variable values in the diagram.</td></tr>
</table>



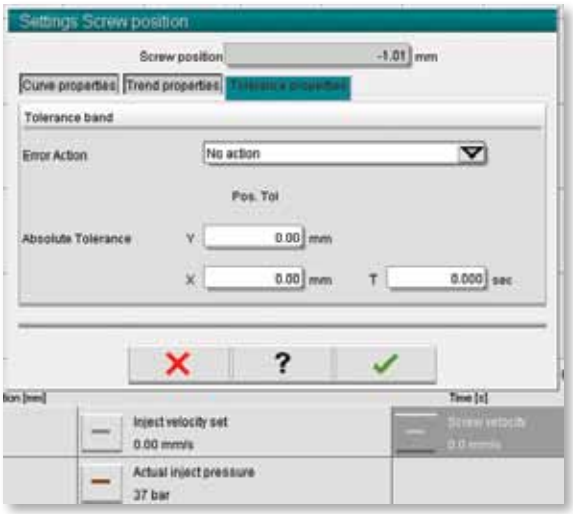
Set-up / Configuration Dialog	
This dialog is accessed by choosing the Set-up, then Configuration button.	
Field	**Description**
Display mode	Selection of the display type for the diagram. *Time:* Displays the measurement as y/t graph. (injection and hold pressure). *Position:* Displays the measurements as y/x graph. (inject only). *Split (Position/Time):* Displays the measurements in two diagrams, as y/x graph (injecting) up to reaching of the change-over point, then as y/t graph (hold pressure). The display may be changed while a measurement is running.
Duration	Specifies the duration for the measurement. This field can only be modified when the measurement is stopped. Attention: This also effects a deleting of all trends, references and measurement curves. This option is only active in the display modes 'Time' and 'Split'.
Interval	Displays the time period between two measurements. This is automatically calculated by the system. This field is only available in the display mode 'Time'.
Set proposal	The application suggests values for the 'Measuring interval' and 'Interval' based on the set ramps and profiles. These values can be adopted using this button. The new measurement interval is adopted in the process. The 'Interval' value shows the minimum measuring interval. This option is only active in the display modes 'Time' and 'Split'.

Parameter Settings
This dialog is accessed by clicking on the legend element of the desired curve, e.g. Inject Velocity set (shown below).    This dialog contains the three tabs "Curve properties", “Trend Properties” and "Tolerance properties".

Curve Properties Tab	
Element	**Description**
Scale	100%: 0%:
Line Color	Selection of the line color.
Interval	Displays the time period between two measurements. This is automatically calculated by the system. This field is only available in the display mode 'Time'.
Actual curve visible	Specifies whether the curve in the diagram is displayed.



Trend Properties Tab	
Element	**Description**
Ref. curve activated	Specifies whether the curve is to also be adopted as reference curve. The 'Actualize' button adopts the actual shot as reference curve.
Activated	You can specify here whether the trend curves are saved and displayed for the curves.
Delete last	Deletes the last saved trend curve.

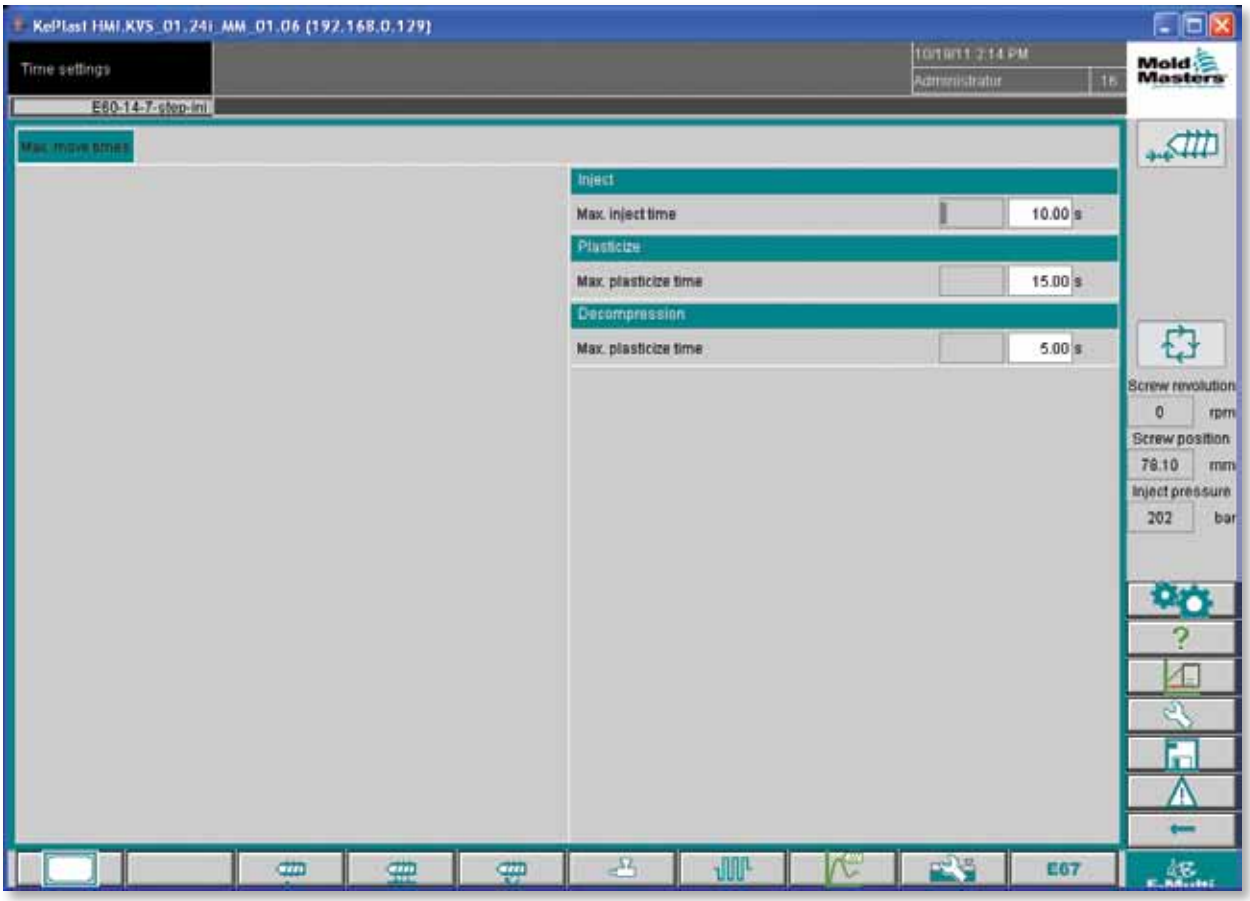


Delete all	Deletes all saved trend curves.

Tolerance Properties Tab	
Element	**Description**
Error action	Specifies which action to execute if the curve is not completely within the tolerance range of the monitoring tube.
Absolute tolerance	The tolerance range of the monitoring tube can be specified here (maximum deviation for X, Y, and T).

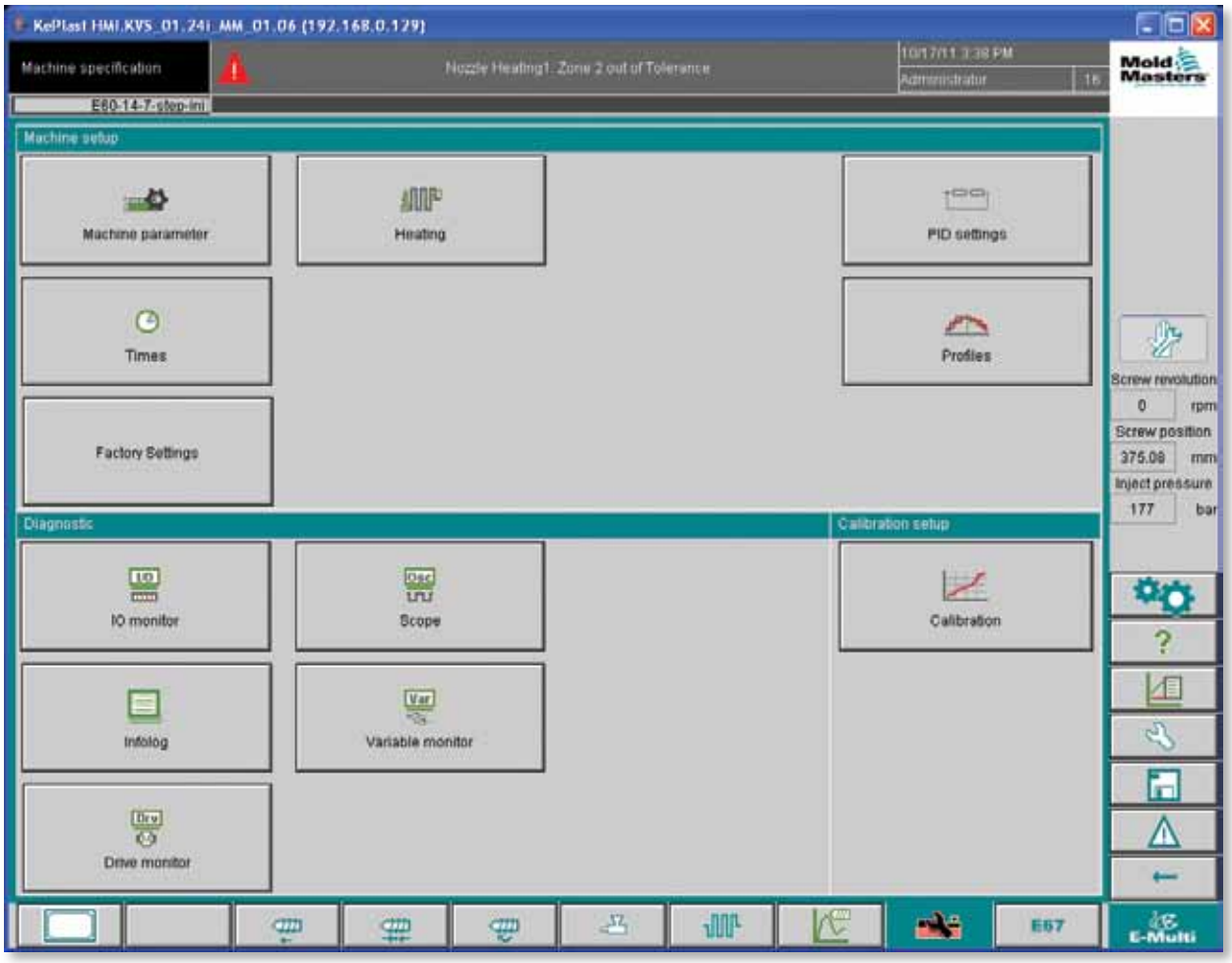
Export Settings	
This dialog is accessed by choosing the Set-up, then Export button.	
	The selection between the Binary Format (later import for viewing possible) and Text (for import into Excel) is made in the group *Output mode* format. The group *Output mode* is used to select between Manual mode and Automatic mode. Manual mode means that on activation of the "Start Export" button the current and complete measurement is output once into the specified file. Any file with the same name is overwritten. Automatic Mode means that at the start of the next measurement the data are written into the specified file in the format selected. The export can either be explicitly terminated by the user or terminated if the end criterion is reached (File Count). The specification of an Interval > 1 enables the selective omission of measurement. With binary measurements exactly one file will be created in the automatic mode for an order (Output in the area Output file under Name). These are then automatically given a consecutive number by the system (e.g.: MyExportFile000.bin, MyExportFile001.bin). After notification to the user any given measurement sequence with the same name is completely deleted prior to the start of the new measurement.

Time Settings Screen – Max. Act. Times tab



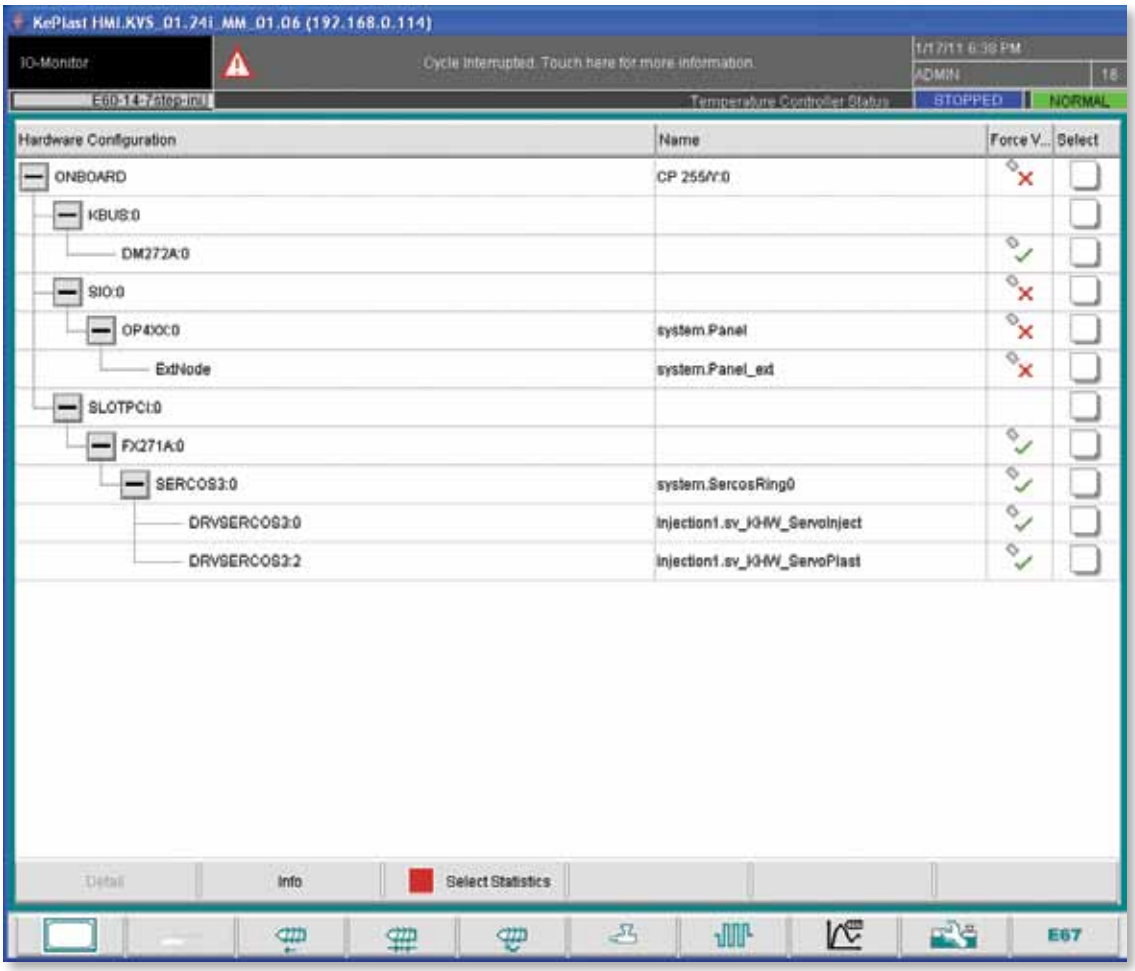
Purpose	
This screen is used to set maximum times for the production process.	
Description of the Elements	
TMaximum time settings can be made for the following areas: • Injection • Plasticize • Carriage (Nozzle)	
Screen Elements	**Description**
Inject	
Max. inject time	Specifies the maximum permitted injection time, without delay time. If this time is exceeded an alarm will be triggered and the cycle will be stopped.
Plasticize	
Max. plasticize time	Specifies the maximum permitted plasticizing time, without delay time. If this time is exceeded an alarm will be triggered and the cycle will be stopped.
Decompression	
Max. plasticize time	Specifies the maximum permitted purging time (without delay). If this time is exceeded an alarm will be triggered and the cycle will be stopped.

Machine Specification Screen



Purpose
This screen serves as a central access point for all configuration screens as well as service and maintenance screens.
Description of the screen
The screen is divided into the areas of machine settings, calibration settings (configuration screens) and KEBA screens (service and maintenance screens). The respective screens are opened via the corresponding buttons.

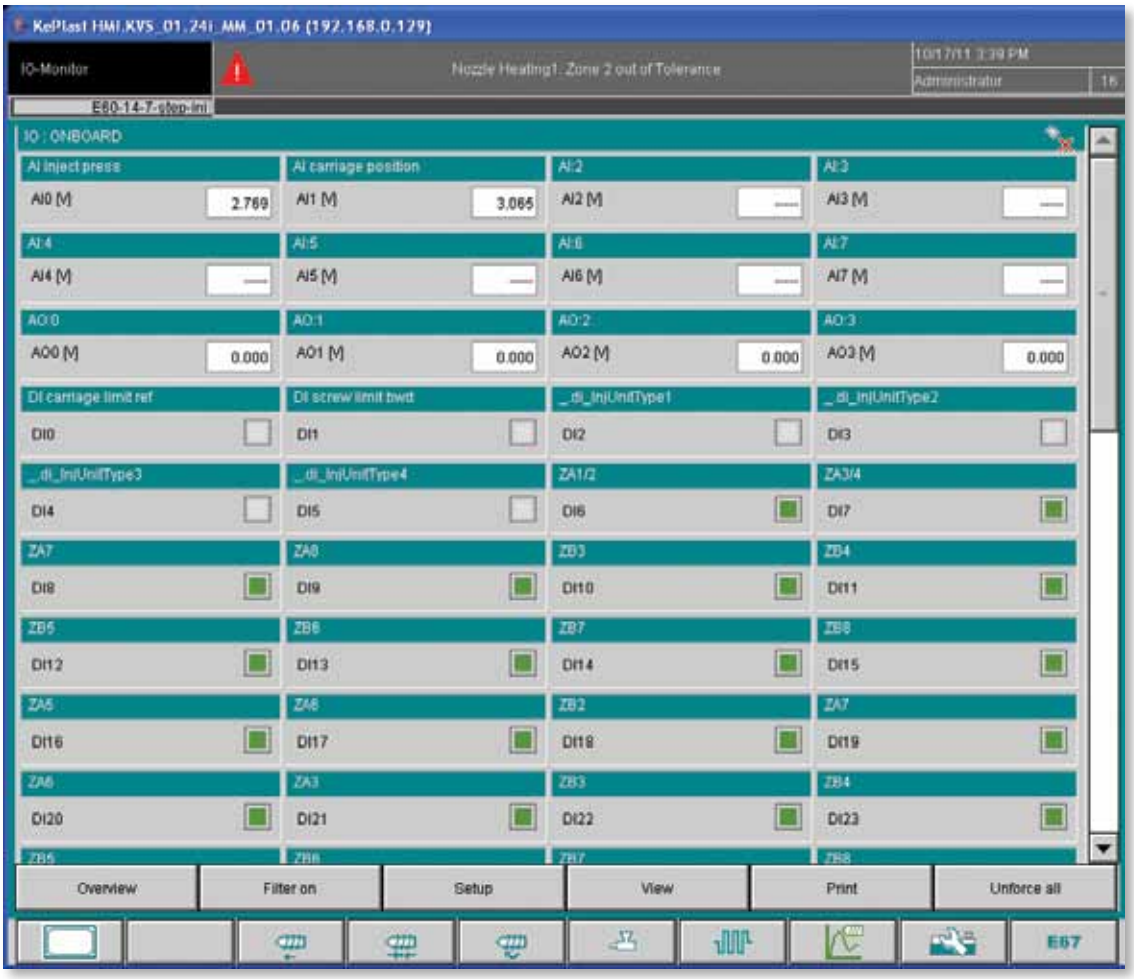
IO Monitor Overview Screen



Purpose	
The IO monitor screen displays the status of the inputs and outputs of the hardware modules.	
Description of the Elements	
The IO monitor screen is divided into two areas: • Overview • Detail (see chapter IO monitor - detail)	
Overview Screen	
The Overview screen is used for the selection of one or more hardware modules. The modules are represented hierarchically in a tree structure, as they are integrated in the system (connections of CPU modules via bus couplers, K-Net, K-CAN, SIO, etc. to the hardware modules). The hardware modules required can be selected by clicking on the checkbox in the right column. Selecting one structure element will mark all elements located below. To de-select a module, click on it again.	
Screen Elements	**Description**
Detail	Switches to the detail view of the selected module (see *IO monitor - detail*).
Info	Shows additional information on the selected modules.

Screen Elements	Description
Select Statistics	Starts or stops the selected CPUs. CPUs may also be restarted (Reset).
Start / Stop	All available CPUs are displayed here below each other. The state of the CPU is displayed as follows: CPU is running. CPU is stopped.
Start / stop	The selected CPU is started or stopped according to its state.
Reset	The selected CPU is restarted.

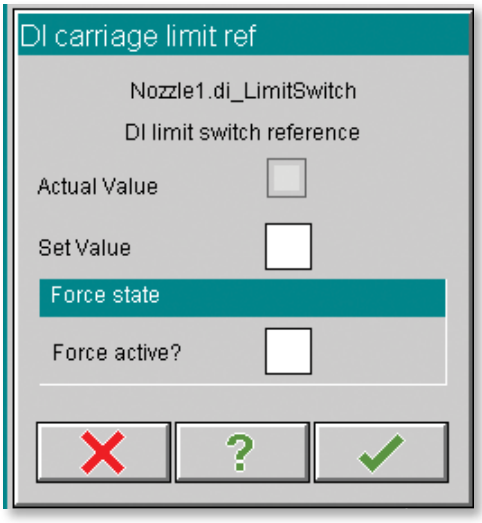
IO Monitor Detail Screen



Purpose
For purposes of debugging error analysis the input/output values can be forced in this screen.
Description of the Elements
For each selected hardware module, the current values of the inputs and outputs are displayed.

Screen Buttons	Description
Overview	Shows the selection of modules.
Filter on / off	The filter for the display can be switched on or off with this button.

Screen Elements	Description
Setup	Opens the dialog for the filter settings (selection of the modules to be displayed (DI, DO, etc.)). Note: Temperature inputs and/or outputs are taken into account account with the filters AI and/or AO.
View	Opens a sub-menu for the selection of the following views: Compact: Only the connection designations and the status icons are displayed. Normal: The assigned system variable is displayed besides the connection designations and the status icons. List: Shows the connections in tabular form.
Print	Prints the current view.
Unforce all	This button can be used to cancel all forced IO states..
The states of the inputs or outputs are displayed with the following icons:	
	Digital input/output (DI/DO) state off.
	Digital input/output (DI/DO) state on.
	Analog output (AI/AO) with example value 2.5 V. Temperature inputs (TI) are displayed the same as analog inputs.
	Input or output forced
	Error

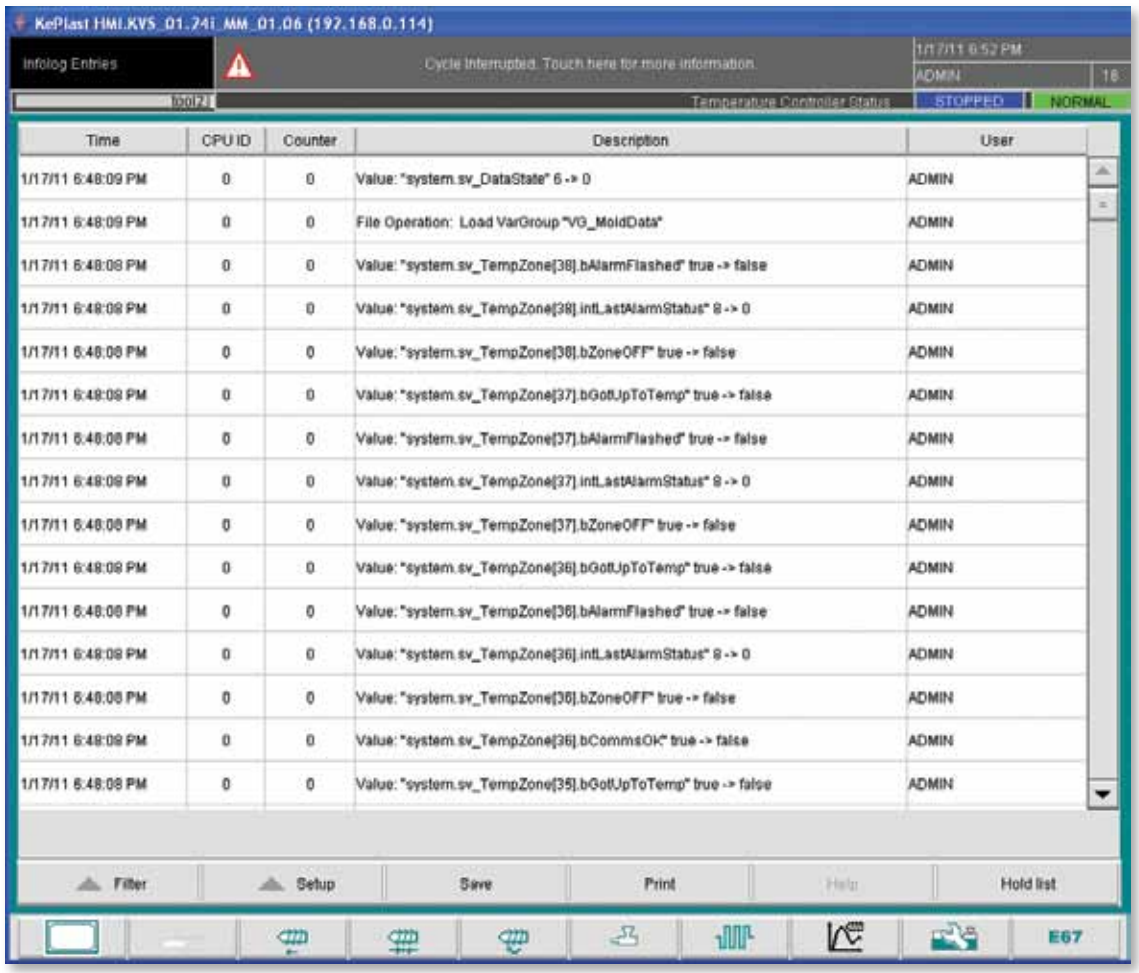


By selecting an input or output, a corresponding input dialog appears for modifying the respective values or states.
Information
By opening the input dialog, the long name of the related system variable is stored in the clipboard. This can be inserted into the text field of the parameter selection in the settings dialog of the software oscilloscope and the screens of the process data package (via the insert-key of the virtual keyboard).

The header of dialog shows the short name of the variable. Underneath it the variable name and the long text for the variable are displayed.

Screen Elements	Description
Actual value	Current value of the input/output. Note: In case of a sensor failure, this field will show "-----". A forced value, however, will still be shown with a red border.
Set Value	Value the input/output is forced to.
Force active	Activates the forced setting of the value.

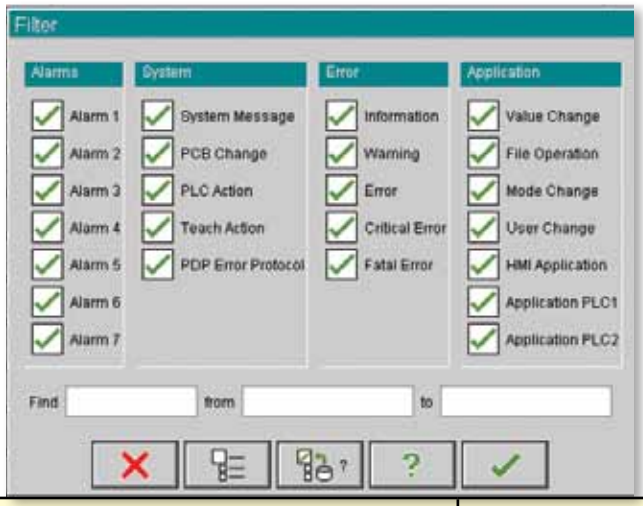
Info Log Screen



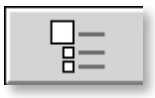
Purpose
System events (alarms, user changes, system errors, etc.) are recorded or logged in the Info log. In this way a complete machine history, for example, can be realized. The Info log screen only displays information. Alarms cannot be confirmed here.
Description of the Elements
All system events are shown in the table. A status line underneath the table shows the entire text of the selected entry. Using the menu bar, the entire info log can be saved or printed out. The list can be limited to specific system events using the aid of a filter. This makes it easier to find entries.

Screen Buttons	Description
Filter	Allows a filter to be selected. Pressing the button restricts the display according to the filter settings. The filters for alarms, system, errors and application are predefined. By selecting filter off, all entries can again be displayed.
Setup	Independent filters can be defined via menu item Filter and the entries searched for text or time of occurrence. Also settings for the display of events can be made (display of long text, log file on and chronological display of events).
Save	The entire Info log can be written to any file that is selected via the file selection dialog.
View	Opens a sub-menu for the selection of the following views: Compact: Only the connection designations and the status icons are displayed. Normal: The assigned system variable is displayed besides the connection designations and the status icons. List: Shows the connections in tabular form.
Print	Opens a printer-dialog and prints out the Info log. All currently displayed messages will be printed.
Help	Displays the corresponding help page for the selected line (help for the Info log class).

Setup / Filter Settings	



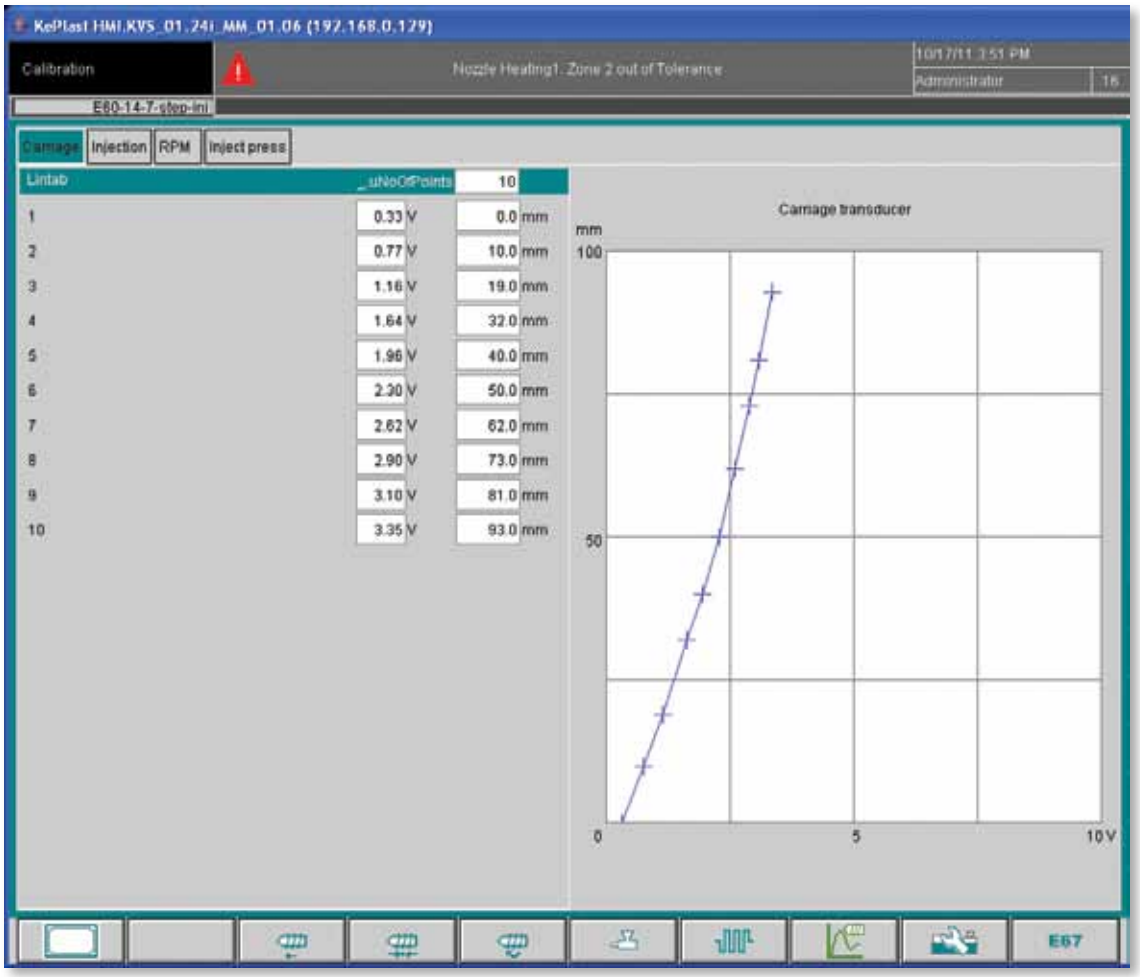
Screen Elements	Description
Check boxes (Alarm, System,….)	The corresponding Infolog class is displayed by selecting a check box. All Infolog classes are selected by default.
Find	The Infolog entries are searched for the search term entered here and displayed with OK.
from / to	A specified time period can be entered in these input fields which restricts the Infolog entries displayed.
OK	Confirm the entries.

Screen Elements	Description
	Clears the text boxes Search, from and to or the content of check boxes when the entry fields are empty. By pressing this button all checkboxes are reset again.
	Loads predefined basic settings.
Help	Displays the corresponding help page.
Cancel	Closes the dialog. Changes are not adopted.

Logged events			
Alarm:			
Text in the filter dialog	**Infolog class**	**Description**	**Example**
Alarm 1 - 7	1-7	Alarm	
System:			
System message	8	Firmware message	tarting / stopping system (cold start, new start,…)
Module exchange	17	Module exchange	Entry with new Serial. no., rev., module name,...
PLC action	18	PLC operation	Starting / stopping PLC, starting / stopping debug session,...)
Teach action	19	Action in the online dialog system	Starting /stopping / error of the KEMRO.teachcontrol run time system
PDP error protocol	22	Error protocol of the PDP	Warning limits violation, tolerance limits violation
Error:			
Text in the filter dialog	**Infolog class**	**Description**	**Example**
Note	9	System information	Information of the PLC runtime system at start-up
Warning	10	System warning	Error when reading a config. entry, SV not found, etc.
Error	11	System error	Errors which affect the control (e.g. FU could not be started, etc.)
Critical error	12	Critical system error	Error which has a critical effect on the system (insufficient memory, etc.)
Fatal error	13	Fatal system error	Total crash
Application:			
Text in the filter dialog	**Infolog class**	**Description**	**Example**
Change in value	14	Operator actions	Changes in value via user input
File operation	15	File operations	Loading/saving files (e.g. recipes, etc.)
Mode	16	Switching operating mode	Changing operating mode
Change of user	20	Action of the user administration	User login/logout, administration actions

Text in the filter dialog	Infolog class	Description	Example
HMI application	21	Application-specific action in the visual-izatio	Entry from the HMI application
Application PLC 1	23	Application-specific action in control 0	1st entry from IEC application
Application PLC 2	24	Application-specific action in control 1	2nd entry from IEC application

Calibration Screens



Calibration - Carriage
Purpose
This screen is used for the calibration of the carriage (nozzle) transducer of the machine.
Description of the screen
The Table shows the values of the individual stages, where they can also be changed manually. The linear-ization table is situation on the right half.

Linear Table - Description of the Elements	
Field	**Description**
No. of points	Number of points in the linearization table.
1 - n	After the auto calibration, the values determined in the process (voltage at position) will be entered automatically into the fields. All values can be subsequently changed by manual entry.

Calibration - Injection	
Purpose	
This screen is used for the calibration of the injection transducer of the machine.	
Description of the Screen	
The Table shows the values of the individual stages, where they can also be changed manually. The linearization table is situation on the right half.	
Linear Table - Description of the Elements	
Field	**Description**
No. of points	Number of points in the linearization table.
1 - n	After the auto calibration, the values determined in the process (voltage at position) will be entered automatically into the fields. All values can be subsequently changed by manual entry.

Calibration - RPM	
Purpose	
This screen is used for the calibration of the screw's rpm per minute of the machine.	
Description of the Screen	
The Table shows the values of the individual stages, where they can also be changed manually. The linearization table is situation on the right half.	
Linear Table - Description of the Elements	
Field	**Description**
No. of points	Number of points in the linearization table.
1 - n	After the auto calibration, the values determined in the process (rpm at velocity) will be entered automatically into these fields. All values can be subsequently changed by manual entry.

Calibration - Injection Pressure	
Purpose	
This screen is used for the calibration of the injection pressure of the machine.	
Description of the Screen	
The Table shows the values of the individual stages, where they can also be changed manually. The linearization table is situation on the right half.	
Linear Table - Description of the Elements	
Field	**Description**
No. of points	Number of points in the linearization table.
1 - n	After the auto calibration, the values determined in the process (voltage at position) will be entered automatically into the fields. All values can be subsequently changed by manual entry.

Section 10 - Maintenance

Cleaning

WARNING
Do not use lacquer thinner to clean the machine.

1. Periodically wipe exposed parts of the machine with a clean, oil free cloth.
2. If necessary, the machine can be cleaned with a damp cloth moistened with soap and water or dusted with compressed air.
3. Make sure to wipe machine with a dry cloth after washing to prevent rust.
4. Clean the barrel and heaters with non-lubricated compressed air only.
5. Do not remove lubrication from the ball screws or linear guides.

Off Line Storage

Store in cool dry place, not direct sunlight.

- Store safely so the unit will not be accidently moved or damaged.
- Use light oil to coat surface of beam that mates with mold.

Corrosion Protection

1. Purge any plastic from the unit before storing.
2. Parts of the AIU will oxidize (rust), especially in environments with any moisture or salt in the air.
3. Before the unit is placed in storage it should be thoroughly cleaned and non-painted surfaces sprayed with a protective coating.
4. Do not wrap the unit in plastic wrap as this may trap condensation. The unit can be further protected by vacuum sealing in a polyethylene bag with a silicate absorbent.
5. The coating should offer good protection from moisture, mild acids and alkaline conditions. It should not contain chlorinated solvents or silicone. *Mold-Masters* recommends LPS 2® Heavy-Duty Lubricant or LPS 3® Premier Rust Inhibitor or equivalent, see below:

Heavy-Duty Lubricant e.g. LPS 2® Heavy-Duty Lubricant	Rust Inhibitor eg. LPS 3® Premier Rust Inhibitor
• Nondrying, oily film for long lasting lubrication • Loosens rusted and frozen parts • Protects against corrosion on steel parts indoors for up to one year • Displaces moisture • Excellent protection for hand/machine tools • Does not contain chlorinated solvents or silicones • Non-conductive • Safe on most surfaces • Meets NSF requirements for H2 Registration: category H2 #129026 Aerosol, #059848 Bulk • Canadian Food Inspection Agency - Category n1 (or equivalent)	• Forms a transparent, soft, waxy film for protection and lubrication • Inhibits rust and corrosion; protects steel parts indoors for up to 2 years • Inhibits exfoliation and filiform corrosion of aluminum • Penetrates to displace moisture • Does not contain chlorinated solvents or silicone • Nonconductive • Safe on most surfaces • Meets NSF requirements for H2 Registration: #129027 (aerosol), #059849 (bulk) • Canadian Food Inspection Agency - Category n1 (or equivalent)

Protecting AIU Surfaces from Damage

1. Never leave or store the AIU on the factory floor. Factory contaminates, water spillage, etc. can damage the unit resulting in costly repairs.
2. If possible, the AIU should be stored as a complete unit.

Lubrication

1. Periodically lubricate linear guides using grease gun and high quality synthetic grease.
2. Lubricate ball screws every 3 months. Please reference installation drawing supplied with unit for locations.

NOTE
For continued warranty support use only *Mold-Masters* approved grease; Part # 104L1111I.

Checking Oil level

WARNING
This procedure requires guards to be removed. Lock out / tag out AIU before removing the guards.

3. AIU should be in horizontal or vertical position.
4. Oil level is checked using fill holes on either side of the housing.
5. Remove plug from fill hole. Oil level should be up to lower threads of fill hole.
6. If necessary, top up with synthetic gear oil 75W-90EP; *Mold-Masters* Part # 104L11081.

NOTE
For continued warranty support use only synthetic gear oil 75W-90EP; *Mold-Masters* Part # 104L1108I.

Recharging the High Pressure Oil Circuit

From time to time, it may be necessary to recharge the oil in the injection housing.

Injection pressure is monitored by the controller using the pressure transducer. If the pressure drops, the controller will notify the operator that the system needs to be recharged. The operator can also check the oil pressure from the controller screen. For E60 units the Inject Pressure should be 75-85 bar and for E490 units the pressure should be 25-35 bar.

Recharging the system is done with an optional oil fill kit. The kit allows the operator to charge an E-Multi AIU to the recommended pressure.

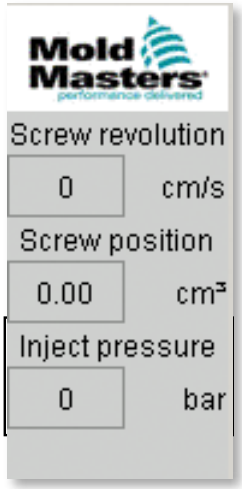


Figure 22: Inject Pressure

Oil Fill Kit

What's in the box

- Oil gun
- Bag of parts
- Fill tube with fittings
  - Tee with fittings
  - Pressure gauge
- Flexible hose, 2m with quick connects

NOTE
For continued warranty support use only synthetic gear oil 75W-90EP; *Mold-Masters* Part # 104L1108I.

Assembly Instructions

1. Thread fill tube into port on oil fill gun and tighten.

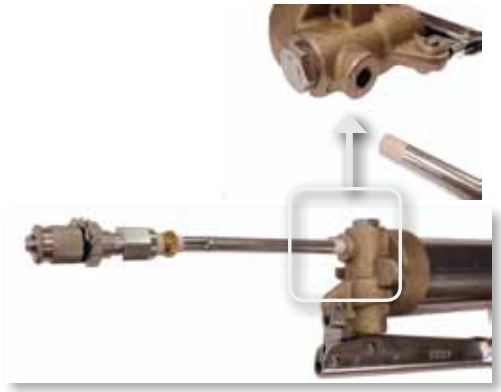


Figure 23: Thread Fill Tube into Oil Fill Gun Port

2. Thread gauge into port on tee and tighten so gauge face is parallel to wrench flats on tee.

Figure 24: Thread Gauge into Port

3. Fill 500ml synthetic oil into oil gun.
4. Connect tee to quick disconnect port on injection housing.
5. Connect flexible hose to tee and fill tube.

Figure 25: Connect Hose

Operating Instructions

1. Power up controller and engage emergency stop.
2. Open bleed nipple by turning counterclockwise.
3. Pump gun until no more air bubbles emerge from bleed tube.
4. Close bleed screw.
5. Pump gun until pressure gauge reads 0.9 ± 0.3bar for E490 units or 2.7 ± 0.3bar for E60 units.
6. Put a rag under the manifold to catch oil when disconnecting fill kit.
7. Disconnect tee from injection housing using quick connect.
8. Put caps on both quick connects.

WARNING
Do not run machine with fill kit attached. Damage to the machine and serious injury to the operator may result.

9. Check the injection housing oil levels. This will prevent pressure build up in the case resulting from any small internal leakage that may have occurred. Remove the fill ports, check the oil level and drain or top-up as necessary. Re-install the drain ports.

CAUTION
Ensure you do not open the high pressure oil plug.

Figure 26: Oil Fill Port (Not to be Confused with High Pressure OIl Plug)

Barrel Removal and Installation

WARNING
Contact with the barrel can cause severe burns. Exercise caution when working on or around a hot barrel.

CAUTION
Thermocouple connections on the barrel are easily damaged. Do not position the barrel so it bears on the thermocouples or allow the barrel to roll onto the thermocouples.

NOTE
This procedure assumes the replacement barrel is clean and the feed screw can be moved by hand. This is required so that the screw can be reattached to the injection housing without having to move the housings.

Preparing the AIU for Barrel Removal and Installation

1. Purge the barrel as described in *"Purging the Barrel" on page 10-15.*
2. Move the carriage to the fully back position.
3. Move AIU to maximum shot volume (housings completely separated).
4. Remove feed tube and feed hopper.
5. Secure the machine as described in *"Lifting the AIU" on page 10-8.*

6. Unbolt the AIU from the molding machine.
7. Separate the AIU from the molding machine by lifting (vertical mounting) or moving sideways (horizontal mounting).
8. Shut down and lock out controller.
9. Purge cooling water from the machine as described in *Section 10 - Maintenance "Purge Cooling Water from the System".*
10. Disconnect water connections from the AIU.
11. Disconnect pneumatic connection from the AIU.
12. Disconnect I/O, heater and motor connections from the AIU.
13. Lift the AIU as described in *Section 10 - Maintenance "Lifting the AIU"* and move to work surface.
14. If required, change the AIU orientation to horizontal.
15. Clean barrel and nozzle area, remove any plastic residue.

Removing the Barrel

NOTE
If the screw is to be separated from the barrel, follow instructions to remove screw first. See *"Feed Screw Cleaning and Replacement" on page 10-6.*

16. Remove guards.
17. E490 units - remove six m8x25 screws securing the feed screw to the feed drive shaft.
18. E60 units – unscrew the collet holding feed screw to feed drive shaft.
19. Remove four m8x35 screws from the feed block.
20. If the feed block will also be changed, place a clean, absorbent cloth under the water cooling connections on the feed block and disconnect the water lines; remove bolt securing the vibrator.
21. Remove the feed block and tie back, out of the way.
22. Remove the large nut securing the barrel to the barrel housing.
23. Remove wire ties as required to remove heater and thermocouple cables from support beam.
24. Remove four m5x12 screws securing heater connector to support beam.
25. Remove barrel by pulling away from barrel housing until barrel clears barrel housing. Barrel may now be lifted up and away from the support beam.

CAUTION
Barrel assembly on E490 units may weigh up to 30kg.

Transferring Heaters and Thermocouples to New Barrel

(if required)

Heater and Thermocouple Removal

1. Number all heaters and thermocouples and note orientation of connectors and wires. Heaters and thermocouples are numbered starting with #1 at the housing end of the barrel.
2. Clean end of barrel, plastic residue on barrel will make it difficult to remove the heaters.
3. Remove wire ties if required.
4. Remove thermocouples from their mountings.
5. Remove thermocouple sockets from barrel.
6. Remove one m6x12 screw securing grounding strap to barrel.
7. Loosen clamp screws on heaters.
8. Slide heaters off barrel one at a time.

Heater and Thermocouple Installation

1. Install heaters in reverse order of removal. Barrel will have alignment markings that show correct heater locations. Tighten clamping screws on heaters.

NOTE
Take care that heater cables are not twisted when installing heaters.

2. Apply anti-seize compound to thermocouple sockets and install. Tighten to finger tight plus 1/8 turn more.

CAUTION
Do not overtighten thermocouple sockets. It is extremely difficult to remove seized sockets.

3. Install thermocouples into sockets. Thermocouples should be tight in sockets, if thermocouples are not tight, move nut on thermocouple housing so that thermocouple is tight when attached to socket.
4. Reconnect ground strap using one m6x12 screw, torque to 16Nm.
5. Install new wire ties if required.

Installing the Barrel

1. Lift the barrel into position in the support beam.
2. Slide the barrel into the barrel housing with the flat face facing up.
3. Install large nut onto end of barrel, tighten to finger tight.
4. Install feed block into barrel housing.
5. Check gap between barrel housing and feed block, it should be uniform for the entire contact surface.
6. Apply a light coat of synthetic grease to the four m8x45 screws, install and finger tighten.

CAUTION
Incorrect tightening of the screws may result in uneven clamping of the barrel, and may cause damage to the machine.

7. Tighten screws in steps, in a cross pattern, ensuring that the gap between the contact surfaces remains constant as the screws are tightened. Final torque to 29Nm in a cross pattern.
8. E490 units - tighten barrel nut with large hook spanner.
9. E60 units - tighten barrel lock nut.
10. Re-install heater connector using four m5x16 screws, torque to 9.5Nm in a cross pattern.
11. E60 units - position feed screw nut so that the end of the nut and the end of the screw are flush, ± 2mm.
12. Mate feed screw into feed screw drive.
13. E490 units – install six m8x45 screws, torque to 29Nm in a cross pattern.
14. E60 units – tighten collet securing feed screw to feed screw drive.
15. Re-install guards and check for interference with heater and thermocouple wires.

Heater Replacement

The heaters are labeled 1-6 (or 7 for E490 models), with heater #1 next to the barrel housing, and heater #6 (or 7) at the nozzle end.

WARNING
Use caution. The barrel will be extremely hot for some time after shut down. Once guards are removed wear heat resistance gloves or wait a number of hours until the barrel has cooled down.

NOTE
If there is plastic residue on the nozzle tip it must be cleaned off to allow heater removal.

To avoid mixing up heaters and thermocouples, number them prior to removal.

1. Move carriage to fully back position.
2. Cut the wire ties to free heater wires.
3. Remove the heater connector insert from connector base.
4. Unscrew heater wires from insert.
5. Loosen lock nut on strain relief.
6. Pull heater cable out of connector base.
7. Remove connector base.
8. Loosen heater clamping screw(s).
9. If required, remove thermocouples and thermocouple retaining sockets.
10. Slide heater off end of barrel. If the failed heater is not at the end, remove heaters before failed heater as well.
11. Using old heater as a template, cut new heater's wire to same length. Cut braided shield back from wire 5cm (2"). Strip insulation off heater wires to 10mm. Install ferrules using ferrule crimper.
12. Install new heater with heater cable pointing to housing end of barrel. The exception is heater #1 which has to be facing tip end (due to space limitations).
13. Install other heaters as required. Be careful not to twist heater cables when re-installing.
14. Put anti-seize on thermocouple socket threads and re-install the thermocouple sockets. Finger tight plus 1/8th turn. Do not overtighten.
15. Re-install thermocouples if removed. There should be tension on the thermocouple cap when installing. If insufficient tension on the cap, turn cap to provide sufficient tension.

16. Feed new heater cable through strain relief on connector base.
17. Re-install connector base on support beam.
18. Install new wire ties.
19. Tighten lock nut on strain relief.
20. Insert heater wires into terminals on connector insert and tighten.
21. Re-install connector insert.
22. Test heater resistance using multi-meter on connector insert pins.

Feed Screw Cleaning and Replacement

Preparing AIU for Feed Screw Removal

1. Purge the barrel, see *"Purging the Barrel" on page 10-15.*
2. Switch heaters on (F8)  on controller.
3. Enable servos (F10)  .
4. Move thrust housing to maximum shot size (fully separated) (F6)  .
5. Disable Servos (F10)  .
6. Switch heaters off (F8)  .
7. Move the machine to a work surface. See *"Preparing the AIU for Adapter Plate Removal and Installation" on page 10-12*

WARNING
Barrel will be hot, wear appropriate PPE to protect from burns.

8. Clean barrel and nozzle area, remove any plastic residue.
9. Remove nozzle tip, clean plastic out of nozzle opening.

Removal

E490 Units

1. Remove six m8x35 screws securing splined ring to feed drive.
2. Push the screw towards the barrel until the m10x25 screws securing the splined ring retainer is accessible.
3. Remove bolt, retainer and splined ring.
4. Push the feed screw towards the barrel as far as possible.
5. Pull feed screw out through nozzle end of barrel.

E60 Units

1. Unscrew collet securing feed screw to feed drive.
2. Remove retaining nut from screw. Nut is left-hand thread.
3. Push the feed screw towards the barrel as far as possible.
4. Pull feed screw out through nozzle end of barrel.

Cleaning

Use a brass bristled brush to clean plastic from the feed screw.

Installation

E490 Units

1. Insert feed screw into barrel.
2. Push feed screw until end protrudes past barrel end far enough for splined ring to be installed.
3. Install splined ring, retainer and m10x25 bolt. Torque to 29Nm.
4. Push feed screw into feed drive hub.
5. Install six m8x35 screws, torque to 29Nm in a cross pattern.

NOTE
It may be necessary to use a hex key inserted between the hook spanner notches and bolt heads to hold the screw from turning while torquing the bolts.

E60 Units

1. Insert feed screw into barrel.
2. Install collet onto screw end.
3. Install retaining nut onto screw end so that the end of the screw is protruding 1-3mm from the surface of the nut.
4. Tighten collet securing feed screw to drive.

Safety Guards

Guards - Layout

E60 shown, E490 similar

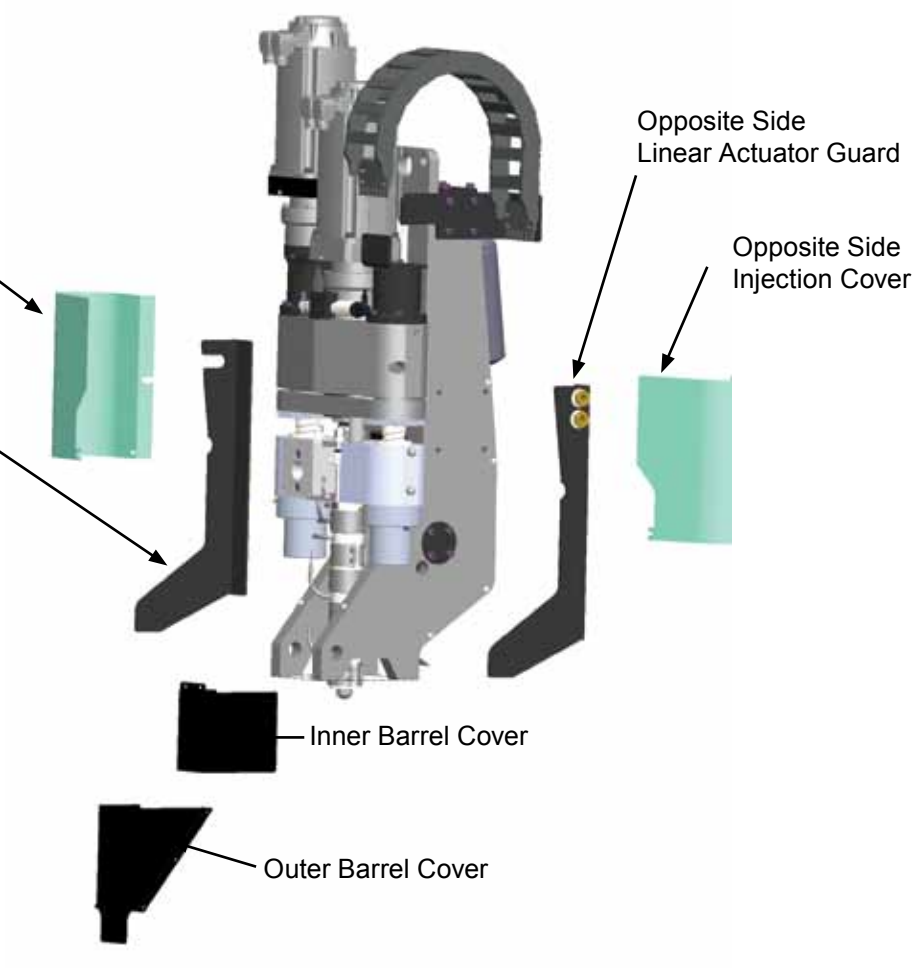


Figure 27: E60 Safety Guards

Guards - Removal and Installation

WARNING

Guards should not be removed unless maintenance is required, and should be replaced after maintenance work is complete. Do not run the machine with guards removed.

NOTE

Linear actuator guards on E60 models are an integral part of the support structure when the machine is placed horizontally on a work surface. These guards should only be removed when the AIU is in the vertical position, or attached to the molding machine or maintenance stand.

E60:

E60 units have three sets of guards: injection covers, linear actuator guards and barrel covers. The inner barrel cover is held onto the barrel housing with two screws, and the outer barrel cover is held onto the beam with five screws. The outer barrel cover screws only need to be loosened, not removed, to remove the cover. The injection covers are held in place by four screws each, two on the sides, one on the feed block side and one on the beam side. Each linear actuator guard is held in place by four screws.

E490:

E490 units have three sets of guards as well: injection covers, beam cover and barrel covers. The injection covers are held in place by three screws, two on the sides and one on the feed block side. The barrel covers are the same as on the E60 units and the beam cover is held onto the beam with six screws.

In both cases, when installing the barrel covers, check that the covers do not pinch the heater or thermocouple wires, and that the covers will not crush or shear the heater or thermocouple wires when the unit moves.

Lifting the AIU

WARNING
When doing any work on the machine that requires lifting the machine, connect all lifting devices and support the machine using a crane of adequate capacity before commencing work. Failure to support the machine can result in costly damage to the machine and severe injury or death.

Auxiliary Injection Unit Lifting Kits (Recommended Option)	
E60	**E490**
2 x 5/8” (16mm) Bow Shackles 2 x 48” Slings 1x E60 Extension Bar	2 x 1” Bow Shackles 2 x 72” Slings 1 x E490 Extension Bar 1 x Extension Bar Mounting Hardware

Prior to Lifting Auxiliary Injection Unit

1. Choose lift equipment that is rated for the prescribed load.
2. Define the load path (the path and orientation the item will move in while it is being lifted, and the location and orientation where it will be set down).
3. Use recommended attachment points only.
4. Identify and avoid potential pinch points (where an individual or a component of the lifting equipment or load may be caught between two surfaces).
5. Secure and balance the load in the chain or lifting device before it is lifted more than a few inches.
6. Minimize swinging by bringing the hook over the load appropriately.
7. Inch powered hoists slowly into engagements with loads.

CAUTION
Never use the motor as an anchor point for lifting. This will result in costly damage to the unit.

Figure 28: Incorrect Use of Motor as Anchor

Vertical Lift Connections

E60 Shown
E490 Similar

E60	E490
Connect sling to motor end of the support beam using one 5/8" (16mm) shackle in lifting hole.	Connect sling to motor end of the support beam using a 1" shackle in lifting hole.

Figure 29: Vertical Lift Connections

Horizontal Lift Connections

E490 Shown
E60 Similar

E60	E490
Connect one sling (A) to motor end of the support beam by feeding it through the lifting hole, with sling on either side of the motor. Connect other sling (B) to barrel end of the support beam using two (5/8") 16mm shackles in the lifting holes. **NOTE:** E60 units require blocks or shipping brackets when set down horizontally to prevent damage to the linear actuator.	Connect one sling (A) to motor end of the support beam by feeding it through the lifting hole, with sling on either side of the motor. Connect other sling (B) to barrel end of the support beam using two 1" (25 mm) shackles in lifting holes.

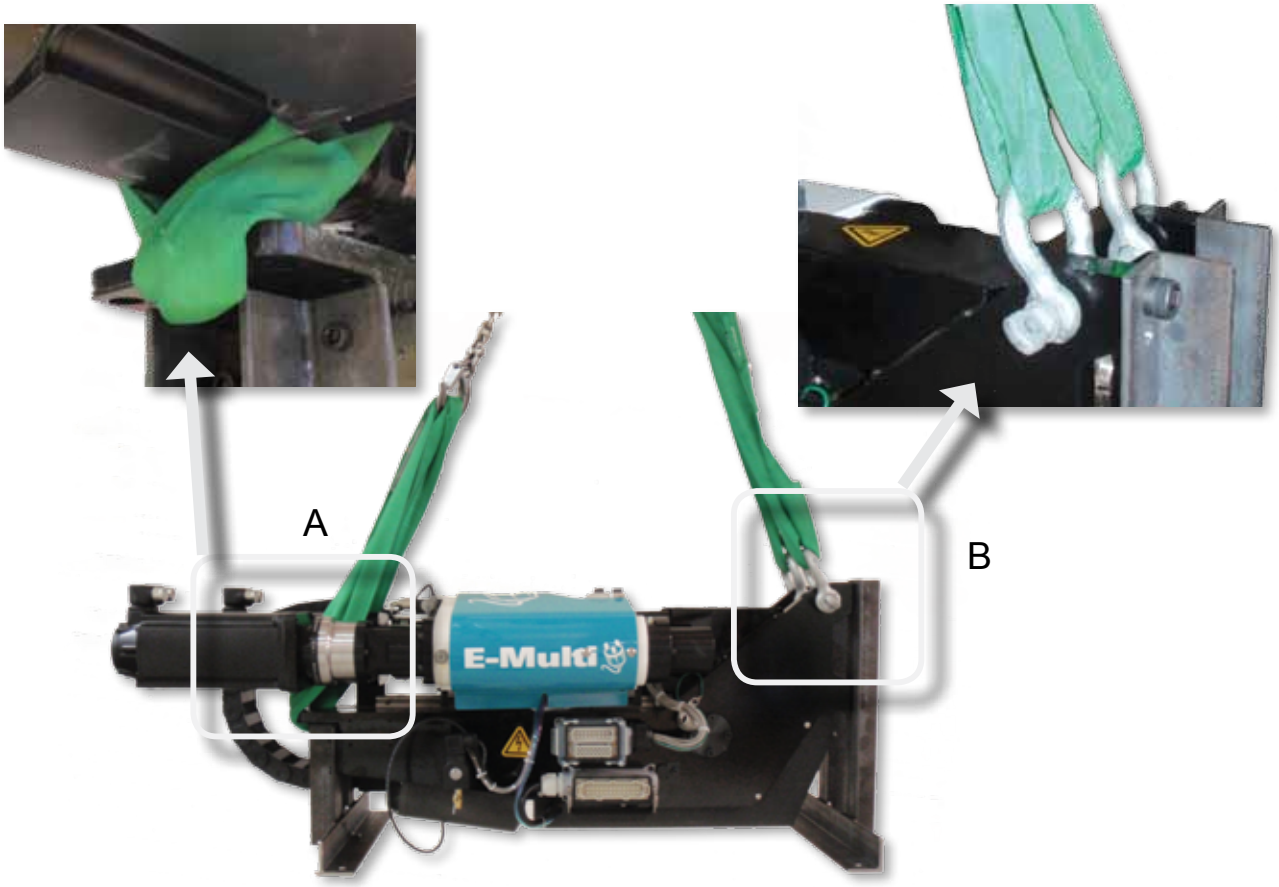


Figure 30: Horizontal Lift Connections

Feed Assembly Removal and Replacement

It is recommended that the barrel be purged before the assembly is changed. See *"Purging the Barrel" on page 10-15*.

If the barrel cannot be purged and the machine is oriented vertically, it is recommended that a container be placed underneath the feed tube to feed block connection to catch the remaining feedstock from the feed tube.

Figure 31: Container under Feed Tube to Feed Block Connection

If the machine is oriented horizontally, it is recommended that as much feedstock as possible be removed using a vacuum cleaner to prevent feedstock from spilling onto the machine.

Removal

1. Purge cooling water from AIU, see *"Purging Cooling Water from the System" on page 10-16*.
2. Remove guards from the system, see *"Guards - Removal and Installation" on page 10-7*.
3. Disconnect any connections to the feed system.
4. For horizontal installations, remove feed hopper from feed block, then go to step 8.
5. Disconnect and remove feed hopper from feed tube.
6. Loosen two m8x25 screws attaching feed tube to feed block.
7. Remove the two screws and lift the feed tube away from the feed block.
8. Remove the vibrator from the feed block and temporarily tie out of the way.
9. If feedstock was not purged from the unit, use a vacuum cleaner to remove feedstock from feed block and barrel.
10. Place a clean absorbent cloth underneath the cooling connections to the feed block and disconnect the cooling lines.
11. Remove four m8x45 screws from the feed block.
12. Remove the feed block from the system.
13. Check the feed block and barrel mating surfaces and clean if necessary, remove any remaining feedstock from barrel.

Installation

1. Install feed block into barrel housing.
2. Check gap between barrel housing and feed block, it should be uniform for the entire contact surface.
3. Apply a light coat of synthetic grease to the four m8x45 screws, install and finger tighten.

CAUTION
Incorrect tightening of the screws may result in uneven clamping of the barrel, and may cause damage to the machine.

4. Tighten screws in steps, in a cross pattern, ensuring that the gap between the contact surfaces remains constant as the screws are tightened. Final torque to 29Nm in a cross pattern.
5. Connect the water cooling lines.
6. Re-install the vibrator and torque bolt to 9.5Nm.
7. For vertical installations, re-install feed tube using two m8x25 screws, torque to 29Nm.
8. Re-install feed hopper.
9. Reconnect feed connections.
10. Reconnect water cooling hoses.
11. Slowly open water cooling valves, check for leaks.
12. Replace guards.

CAUTION
Do not re-use purged feed stock. Damage to the AIU from contaminated feed stock is not covered under warranty.

Injection Nozzle Replacement

Because of the possibility of variation between nozzles, it is recommended that any time a nozzle is changed, the adapter plate be realigned. Changing the nozzle is described in the section *"Installing Adapter Plate onto AIU" on page 10-12*.

Installing Adapter Plate onto AIU

NOTE
This procedure should be carried out on a work bench or table, or machine maintenance stand. Ensure it is capable of supporting the full machine load.

Preparing the AIU for Adapter Plate Removal and Installation

1. Purge the barrel, see *"Purging the Barrel" on page 10-15*.
2. Retract the carriage so that the nozzle tip is on the AIU side of the adapter plate.
3. Secure the machine as described in *"Lifting the AIU" on page 10-8*.
4. Unbolt the AIU from the molding machine.
5. Separate the AIU from the molding machine by lifting (vertical mounting) or moving sideways (horizontal mounting).
6. Purge cooling water from the machine as described in *"Purging Cooling Water from the System" on page 10-16*.
7. Disconnect water connections from the AIU.
8. Disconnect pneumatic connection from the AIU.
9. Disconnect I/O, heater and motor connections from the AIU.
10. Lift the AIU and move to work surface.
11. If required, change the AIU orientation to horizontal.

Adapter Plate Removal and Installation

1. Remove four m16 (E60) or m20 (E490) screws and remove adapter plate.

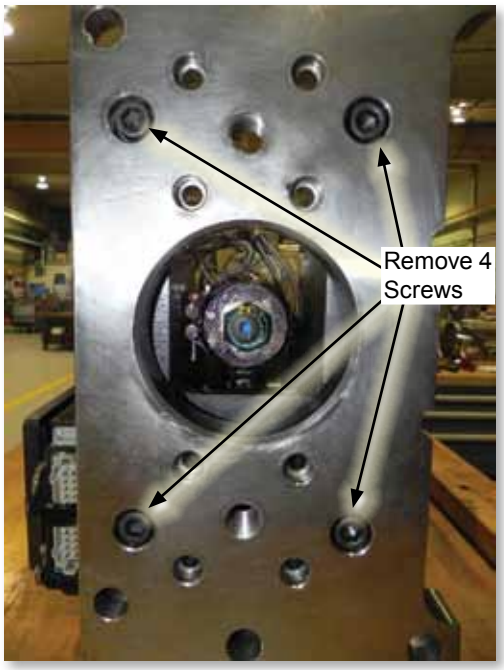


Figure 32: Screws on Adapter Plate

2. Clean barrel and nozzle area. Remove any plastic residue, using soft brass tools only.
3. Remove nozzle tip with a 24 or 25mm (15/16 or 1") socket and clean plastic out of nozzle opening and inner cone.
4. Apply anti-seize to the nozzle tip threads and re-install nozzle tip. Torque to 135Nm.
5. Clean mating surface of support beam with solvent. Wipe with a clean, lint free cloth.
6. Clean mating surface of adapter plate with solvent. Wipe with a clean, lint free cloth.
7. Apply a light coat of oil to both contact surfaces.
8. Remove the barrel side shipping bracket.
9. Install adapter blocks and adapter plate (X models only), or adapter plate only (all other models), but leave screws loose.
10. Remove linear actuator manual access port cover using a 6mm hex driver.
11. Insert a 6mm hex driver into the linear actuator and turn to manually move the nozzle to the opening of the adapter plate.
12. Measure the distance from the nozzle to the adapter plate bore at 12, 3, 6 and 9 o'clock, align so the distance is equal at all positions, and tighten adapter plate bolts.

13. Manually move the linear actuator to move the nozzle fully forward and measure the protrusion from the adapter plate. Verify that the protrusion is correct for the mold to being used. If adjustment is necessary, see *"Nozzle Protrusion Adjustment" on page 10-13*.
14. Manually retract the nozzle past the adapter plate to allow installation onto the mold.
15. Replace linear actuator manual access port cover and tighten.
16. AIU is ready to be installed onto molding machine.

Nozzle Protrusion Adjustment

NOTE
Nozzle protrusion adjustment must be performed when the manifold inlet depth changes, for example when moving the AIU to another molding machine or when a different nozzle is installed. The nozzle protrusion is set from the factory for a 6mm protrusion past the adapter plate.

1. Retract the carriage so that the nozzle tip is on the AIU side of the adapter plate.
2. Remove the AIU from the molding machine as described in *"Preparing the AIU for Adapter Plate Removal and Installation" on page 10-12*.
3. Manually move the nozzle fully forward. See *"Installing Adapter Plate onto AIU" on page 10-12*, steps 10 & 11).
4. Clean residue from the manifold inlet.
5. Measure the distance from the manifold surface (not the locating ring surface) to the opening of the manifold inlet
6. Measure the distance from the tip of the nozzle to the surface of the adapter plate. This distance should be 1mm more than the manifold inlet to manifold surface distance.
7. To adjust the protrusion, loosen the jam screw on the carriage link using a 5mm hex key. The adjuster screw can then be turned to move the nozzle to achieve the correct protrusion. The adjuster screw head size is 32mm (1 ¼"). Once the protrusion is correct, tighten the jam screw to 16Nm(138in-lbs).
8. Manually retract the carriage so the nozzle tip is on the AIU side of the adapter plate.
9. Reinstall AIU as described in *"Attaching AIU to Mold / Machine" on page 6-1*.

Belt Tension Check

Belt tension should be checked every six months. A correctly tensioned belt has a deflection of 1.5 to 3mm (1/16 to 1/8"). If a belt tension meter is available, the correct tension for E60 models is 216-241Hz, and for E490 models is 150-168Hz.

Adjusting Belt Tension

E60 Models:

1. Using a 5mm hex key, loosen but do not remove the five m6 bolts on the eccentric shaft retaining plate.
2. Rotate the eccentric shaft using a 55mm hook spanner until correct belt tension is achieved.
3. Tighten the five m6 screws and torque to 9.5Nm (84in-lb).

E490 Models:

1. Loosen but do not remove the four m12 bolts securing the eccentric shaft cover plate.
2. Rotate the eccentric shaft using a 70mm hook spanner until correct belt tension is achieved.
3. Tighten the four m12 screws, torque to 25Nm (18.5lb-ft) in a cross pattern.

Belt Removal and Installation

WARNING
Lock out / tag out machine before performing maintenance.

CAUTION
Do not rotate ball screws with belt removed, otherwise realignment will be necessary.

E60 Models:

1. Purge plastic from machine.
2. Move injection housing to the fully back position.
3. Remove injection covers. Take care not to drop spacers.
4. With the drive power on, use a 36mm open end wrench to loosen the screw collet.
5. Turn off the drive power, but keep the heaters on.
6. Unscrew the collet and push the screw as far forward as possible.
7. Turn the controller off.
8. Loosen idler pulley clamping screws using a 5mm hex key bit.
9. Rotate the idler eccentric shaft to release the tension on the belt.

10. Remove belt from pulleys.
11. Disconnect the motor connectors from the motors.
12. Disconnect the transducer connector using a 5.5mm slotted screwdriver.
13. Remove four m6x16SHCS securing cable track bracket to the shaft cover on the injection housing.
14. Unfold cable track.
15. Position new belt as shown in *"Figure 33: New Belt Position"*.

Figure 33: New Belt Position

16. If machine is oriented vertically, skip to step 21.
17. Remove linear guide safety screw.
18. Install belt change support block.
19. Install support block jacking screw.
20. Use jacking screw to lift support block until it is supporting injection housing.
21. Mark position of linear guide relative to the injection housing. See *"Figure 34: Linear Guide Marking"*.

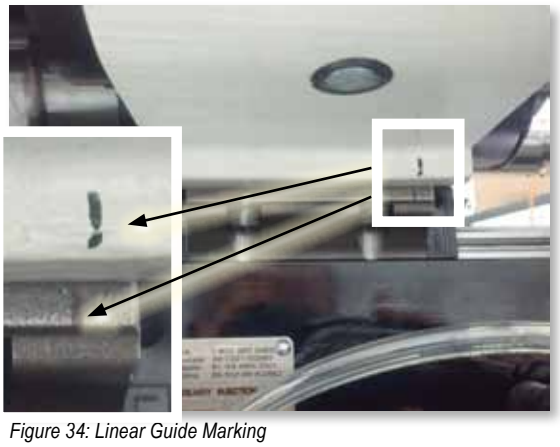


Figure 34: Linear Guide Marking

22. Loosen linear guide screws using a low profile hex key.
23. Unscrew screws with fingers.
24. Slide linear guide out from under injection housing. For E60X models, slide the guide towards the barrel, for E60 models, slide the guide towards the motors.
25. Move belt over injection housing and all the way to the barrel housing.
26. Remove old belt.
27. Move linear guide back into place using marks from step 21.
28. Reinstall screws.
29. Tighten screws with hex key and hex key extender.
30. If machine is in horizontal orientation, remove jacking screw, support block, and reinstall safety screw.
31. Remove the old belt from the machine.
32. Reinstall the cable track bracket to the injection housing shaft cover using four m6x16 SHCS. Torque to 16Nm in a cross pattern.
33. Reinstall transducer cable connector using a 5.5mm slotted screwdriver.
34. Reconnect motor connectors. See *"Connecting the Servo Cables and Routing them through the Cable Track" on page 7-1*.
35. Position belt so it is completely around the opposite side pulley, on the idler pulley, and on top of the connector side pulley. The belt will not reach all the way around the connector side idler, and the part that does not seat must be towards the beam.
36. Taking care that the pulleys don't change position relative to one another and the belt, slowly rotate the pulleys counterclockwise, helping the belt onto the pulleys and idler. Rotate back and forth as required until belt is correctly seated.
37. Tension the belt by turning the eccentric shaft using a hook spanner. See *"Belt Tension Check" on page 10-13*.
38. Tighten the eccentric shaft clamping screws with a 5mm hex key bit. Torque to 9.5Nm (84in-lb) using a cross pattern.
39. Move the pulleys back and forth to check for proper movement of belt.
40. Reinstall screw into drive shaft and tighten collet by hand. If screw cannot be moved, rotate pulleys by hand to move injection housing to the screw.
41. Turn on the controller.
42. Enable the drive power.
43. Tighten the collet using a 36mm open end wrench.
44. Reinstall injection covers. The gap between the injection cover and the injection housing should be the same all the way around the housing.

E490 Models:

1. Move housings to maximum separation.
2. Disconnect screw, see *"Feed Screw Cleaning and Replacement" on page 10-6*.
3. Move screw fully into barrel.
4. Remove AIU from molding machine.
5. If required, move the AIU into the horizontal position.
6. Move the AIU onto a clean, level work surface.
7. Remove the carriage guards, *"Guards - Removal and Installation" on page 10-7.*
8. Disconnect power and encoder cables from both motors.
9. Disconnect oil pressure transducer cable.
10. Purge water from system, see *"Purging Cooling Water from the System" on page 10-16.*
11. Disconnect water cooling lines from the motor and injection housing.
12. Remove four screws holding cable track bracket to injection housing.
13. Fold cable track back into horizontal position away from injection housing.
14. Loosen four bolts securing the belt tensioner plate to the injection housing.
15. Using a hook spanner, rotate the belt tension eccenter to the fully loose position.
16. Remove belt from pulleys.
17. Remove 12 screws securing housings to linear guides.
18. Put a sling around the screw motor reducer.
19. Tilt the injection housing away from the support beam using a crane and the sling on the screw gearbox.
20. Slide the belt over the injection housing towards the motors until it clears the linear guide.
21. Lower the injection housing back onto the linear guide.
22. Remove the sling.
23. Slide the belt over the motors and off the machine.
24. Clean the pulleys and idler surface with solvent and a clean cloth.
25. Slide the new belt onto the motors towards the thrust housing as far as possible.
26. Put a sling around the screw motor reducer.
27. Tilt the injection housing away from the support beam using a crane and the sling on the screw gearbox.
28. Slide the belt over the injection housing towards the barrel housing until it clears the linear guide.
29. Lower the injection housing back onto the linear guide.
30. Remove the sling.
31. Re-install twelve screws securing the housings to the linear guides, tighten in a cross pattern and torque to 29Nm.
32. Slide the belt onto the pulleys.
33. Engage belt with pulleys so that there is little or no slack across the top.
34. Using a hook spanner, rotate the belt tensioner eccenter until the belt deflection is correct, see *"Belt Tension Check" on page 10-13*. Tighten the four screws securing the belt tensioner plate to the injection housing, torque to 33Nm.
35. Move cable track back to operating position.
36. Install four screws securing cable track bracket to injection housing.
37. Reconnect water cooling lines to injection housing and motor.
38. Reconnect oil pressure transducer cable.
39. Reconnect motor power and encoder cables.

Purging the Barrel

WARNING

Material purged from machine will be extremely hot. Ensure protective guards are in place around the nozzle to prevent molten plastic from splashing.

1. Set the controller to manual operation  .
2. Switch barrel heaters on (F8)  .
3. Move carriage back, away from mold (F3)  .
4. Enable servos (F10)  .
5. Once barrel has reached injection temperature, separate injection housing from barrel housing (F6)  .
6. Run feed motor until no more material flows from nozzle (F5)  .
7. Bring injection housing close to barrel housing (F7)  .
8. Run feed motor again until no more material flows from nozzle.
9. Disable servos (F10)  .
10. Switch barrel heaters off (F8)  .

Purging Cooling Water from the System

NOTE

If AIU will be moved frequently, a purging tool can be made to allow fast, clean and safe purging of cooling water from the AIU.

The tool consists of two lengths of hose, a short one with a valve and airline quick connect and a longer one with a heavy weight at one end to prevent the hose from moving when air pressure is applied, both with quick connects to connect to the AIU.

To purge the system, the hoses are connected to the AIU and the weighted end of the hose placed into a bucket. With the air valve off, the other hose is connected to the AIU and to a compressed air supply. By slowly opening the valve, the air purges the water out.

WARNING

Burn Hazard. Do not disconnect water cooling fittings on the machine without first purging the system. If water contacts a hot barrel, steam or hot water may be released from the machine.

This procedure requires compressed air. Do not direct compressed air at body parts, do not look into compressed air stream, and do not look into or at fitting when blowing compressed air into it.

CAUTION

Avoid getting water on unpainted surfaces of the machine such as ball screws, barrel, feed screw, belt tensioner, etc. If water is not removed, unpainted surfaces will rust, causing damage to the machine.

Do not run the system with the water cooling system turned off, disconnected or purged. Serious damage to the machine will result.

1. Turn off water supply and return connections at the manifold.
2. Disconnect return line from manifold and place in a bucket or other suitable container.
3. Disconnect supply line from manifold.
4. Using low pressure (<50psi) compressed air, blow into the supply line until no more water comes out of the return line.
5. Repeat several times to ensure all water has been purged from the system.
6. Check transparent cooling lines on machine to ensure no water remains.

Carriage Home Position Calibration

The first time the AIU is installed, and any time it is transferred to a new machine with a different mold, the carriage home position must be calibrated.

WARNING

This procedure requires visual inspection of the machine while it is moving. Wear eye protection.

NOTE

For proper calibration, ensure nozzle protrusion is set correctly.

1. Put the AIU into setup mode
2. Switch to the carriage setup screen (need to insert proper picture graphic)
3. Move the carriage forward until the nozzle is just touching the manifold inlet
4. Press the box to the right of “set rel. startposition” text at top right corner of the screen.

Injection Home Position Calibration

There are only two instances when the injection home position needs to be calibrated. If the machine program is updated, or the injection motor is removed. The procedure for calibrating the injection home position is as follows:

1. Ensure the barrel is up to temperature.
2. Switch the controller into service mode 
3. Switch to the "Drive Info" screen by pressing the Overview Screen button  , and then pressing the "Drive Info" button  .
4. Press the “Start Reference” button 

.
5. Press F7  button below HMI screen. The text field next to the Start Reference button changes from “Not Referenced” to “Referenced”.
6. Check the position on the top right of the screen, it should be -1.0.
7. The injection drive is now calibrated.

Torque Specifications

Nominal Thread Size	Nm	Ft-lbs
4	4.6	3.4
5	9.5	7
6	16	11.5
8	39	29
10	58	42.5
12	101	75
14	161	119
16	248	181.5

Preventive Maintenance Schedule

Item No.	Preventive Maintenance	Frequency
1	Belt Tension	Every 6 - 12 months
2	Check oil level in thrust housing	Only if oil seems to be leaking
3	Grease linear guides	Every 6 months
4	Lubricate ball screws (4 points)	Every 6 months

Servicing and Repairing your Controller

WARNING
Always isolate your controller at source before you open the unit to inspect it or replace fuses. When it comes to machine maintenance there is very little that you need to do to look after it.

Replacement parts

Mold-Masters does not expect that you will need to repair any controller parts at board level other than fuses. In the unlikely event of any board failure then we provide an excellent repair and exchange facility for all our customers.

Cleaning and Inspection

Every environment suffers some degree of contamination, necessitating the need to inspect the fan filters at regular intervals. The filters are removable and a light tapping action removes loose dirt and dust. Failure to do this reduces the flow of cooling air and may incur more expensive repairs if internal components subsequently overheat. If filters do become clogged, they need to be replaced. Replacement filters can be obtained from *Mold-Masters*. Please quote the model type and year of manufacture.

Any excess dust that has entered into the cabinet may be removed with a light brush and vacuum cleaner. If the equipment is subject to vibration, we recommend you use an insulated screwdriver to check that no terminals have become loose.

External cable looms should be checked to see that there has been no damage to the flexible conduit, plugs or sockets. If the flex has been squashed, if there is visible damage, or if there are any exposed conductors, then, for your own safety, the loom must be replaced.

Upgrading

In order to maintain our high standards of quality, our development engineers at *Mold-Masters* are making continual improvements to our control system. We also listen to customers who will sometime suggest system changes that may be both useful and achievable. Improvements, which are gained from either of these routes, will be offered to our customers and, should you decide that they would be beneficial to your own control system, will be quite straightforward to implement yourself.

There is usually no need to send your control system back to the *Mold-Masters* factory for such upgrades. Instead they will, on request, be sent to you in the form of one Compact Flash Card that can be read by your controller. The following instructions will guide you through the upgrade procedure.

Mold-Masters recommends that you always wait until your controller is free before implementing any upgrade. This ensures that, in the event of a mishap such as an error, or a power interruption at a crucial point, that normal production will not be adversely affected.

1. Turn off power to E-Multi.
2. Check that you have the upgrade Compact Flash Card.
3. Open the front door of the E-Multi Cabinet.
4. Use a pen to press the Compact Flash eject button.
5. Remove the existing Compact Flash Card.
6. Insert the Compact Flash Card with the label to the front.
7. Power up the E-Multi.
8. Confirm version number displayed on the Overview Screen matches the document that came with the upgraded Compact Flash.

Section 11 - Troubleshooting

Thermocouple Electrical Check

The controller system has functionality to monitor thermocouple performance.

1. A working thermocouple will show a realistic temperature based on the environment it is in. Defective thermocouples will read -100ºC on the controller.
2. If a thermocouple shows as defective, change the thermocouple.
3. If the new thermocouple shows -100ºC, there is probably a wiring problem, check the wiring and connections.

Heater Continuity Check

This procedure requires access to the heater connector. Power down the machine before disconnecting heater cable.

1. Testing of the heaters is done with a multimeter set to measure resistance.
2. The heaters are wired to the connector in pairs starting with pin 1 and 17.
3. Checking the resistance across the pins should show around 48 ohms for a 1000w heater and 96 ohms for a 500w heater.
4. A reading of 0 ohms indicates a shorted heater, and a reading of infinity indicates an open heater.

Transducer Output Check

Transducer function is checked automatically every cycle. If the transducer is defective, an alarm will be shown on the controller.

Vibrator Valve Check

1. The vibrator runs on every cycle when the feed screw is turning. If the vibrator is not moving, check the air pressure to the vibrator by closing the air needle valve and disconnecting the air line from the supply side of the valve.
2. Open the needle valve slowly and check for air pressure on the supply line. If there is no pressure, check the pneumatic connection to the machine. If there is pressure, close the valve, reconnect the air line to the valve and open the valve.
3. Next, check the mechanical function by disconnecting the air supply tube from the solenoid valve on the support beam and applying compressed air to the tube. If the vibrator is working properly, it should start to vibrate when compressed air is applied.
4. If the vibrator is working, reconnect the air line to the valve and disconnect the valve cable. Apply 24VDC to pin 1 and 0VDC to pin 2. The valve should open and the vibrator should start to vibrate. If the valve does not move, replace the valve with a known good one.

Troubleshooting the Control System

The control system has several features, which provide an early diagnosis of faults in the control system. If the system detects any malfunctions, it displays an error message on the Alarm screen.
If the system detects any abnormal condition it displays a warning message on the Alarm screen.
See the chart on the next page.

Fault and warning messages

Any of the messages on the following pages may be displayed on the Fault Indication line.

Error Message	Cause	Action
AUTO	The controller has detected a T/C failure and Automatically switched this zone to manual. It is using recorded settings to maintain the zone temperature.	Check from the tool back to the controller for a disconnected Thermocouple.
	(Note: this will only be seen if you have selected “Auto/Manual Mode Enable”)	
ERR!	No temperature rise has been detected in that zone.	Check thermocouple wiring, it may be reversed. Heater wiring may be faulty or element may be open circuit.
FUSE	The fuse for that zone has failed. Please Note: A fuse can only fail due to a fault external to the controller. Identify and rectify the fault before replacing the fuse.	Replace the fuse with one of the same rating and type, i.e. High Rupture Current load fuse. The blown fuse is located either on the control card or on the off-board triac module (If fitted).
GND	The system has detected an earth fault. (Note: this can only be detected by controllers fitted with EM Cards or MD240 diagnostics)	Check your heater wiring for a low impedance path to earth.
HELP	There is a system failure	Please contact *Mold-Masters* Systems
HIGH	The water-flow sensor has detected a high flow rate.	Check that the coolant water system is not blocked or leaking.
LOW	The water-flow sensor has detected a low flow rate.	
LINE	No mains supply synchronisation pulses being received.	Check supply wiring for presence of all three phases.
LOAD	No load on that zone. Only occurs when in manual closed loop mode where the current is pre-set. The current sensing circuit has not detected a current flow; therefore, the zone is flagged as not having a load.	Isolate the system supply and check the connections between the controller and the tool heaters. Also, check the heater for continuity
OVER	The RTD zone has detected a temperature in excess of 99°C	Check the wiring to see that there is no fault. Check that a different RTD has not been fitted.
N/Z	The controller card in this rack position is not responding.	Check card for faults.
NONE	A Zone type appears not to be selected for the card.	There is a communications problem. Try a replacement controller card.
REV	The card has detected an abnormal input at the T/C termination that indicates a shorted or Reversed thermocouple.	If the REV alarm persists then you should switch off the controller and investigate the offending zone.

Error Message	Cause	Action
Alternatively you could slave the offending zone to a good zone until you have time to clear the fault.		
T/C	An open circuit thermocouple has been detected.	For immediate recovery you can either slave that control zone to an adjacent zone or change to open loop control. Later, check to see whether the input fuse on the control card has ruptured or, if the fuse is good, replace the thermocouple.
TRC	Triac fault. This can only occur when in manual mode and automatic mode, where the current is pre-set manually. If for instance, the triac output current is higher than the set point, the controller attempts to reduce output to the level required. If it fails the triac may have failed and it is flagged as faulty.	Check the current output on the channel. If the triac has failed, return to *Mold-Masters*® for repair.

Warning Message	Abnormal Condition
MAN	The control zone is in manual mode.
S #	The zone is slaved to another control zone, where # represents the number of that zone, i.e. S 2 means the zone is slaved to Zone 2. The same power is being sent to both zones. In the Display page, the set point displayed on the selected zone is the same as that on the slave zone.
TEST	Displayed when the zone is in diagnostic test mode.
WARN	If during the test procedure a temperature interaction is found between zones, this message is displayed.
FAIL	The zone under test has failed.
OK	The zone has passed testing.

Section 12 - Compact Stand (Option)

Introduction

The E-Multi Compact Stand supports E-Multi units while in the horizontal feed orientation.

Safety

CAUTION

E-Multi compact stands are intended for support of E-Multi units only.
Do not use these stands for transportation of the E-Multi unit.
When assembled with the E-Multi unit, these stands are TOP **heavy**.
Do not leave stand unattended when assembled with the E-Multi unit.

Standard Features

- Provides support for E-Multi units in horizontal feed orientation.
- Height range from 1100mm to 1500mm.
- 50mm of allowable lateral movement to provide clearance for mold removal.
- Leveling feet provide stable, anti-vibration placement once set in place and allow for an extra 15mm height adjustment.
- Casters within leveling feet provide easy transportation of the stand only (stand is not for use for transportation of the E-Multi unit).

Figure 35: Compact Stand

E60/60X Components

1. AIUM1000277 Base
2. AIUM1000278 Post
3. AIUM1000279 Lifting Frame
4. AIUM1000280 Lifting Frame
5. AIUM1000281 Lever
6. AIUM1000282 Link
7. AIUM1000283 Bushing
8. M12 Washer
9. M12 Nylock Nut
10. AIUM1000289 Hitch Pin w/ I
11. M12X30 Socket Head Cap S
12. M12X40 Socket Head Cap S
13. M12X150 Socket Head Cap
14. AIUM1000284 Leveling Cas

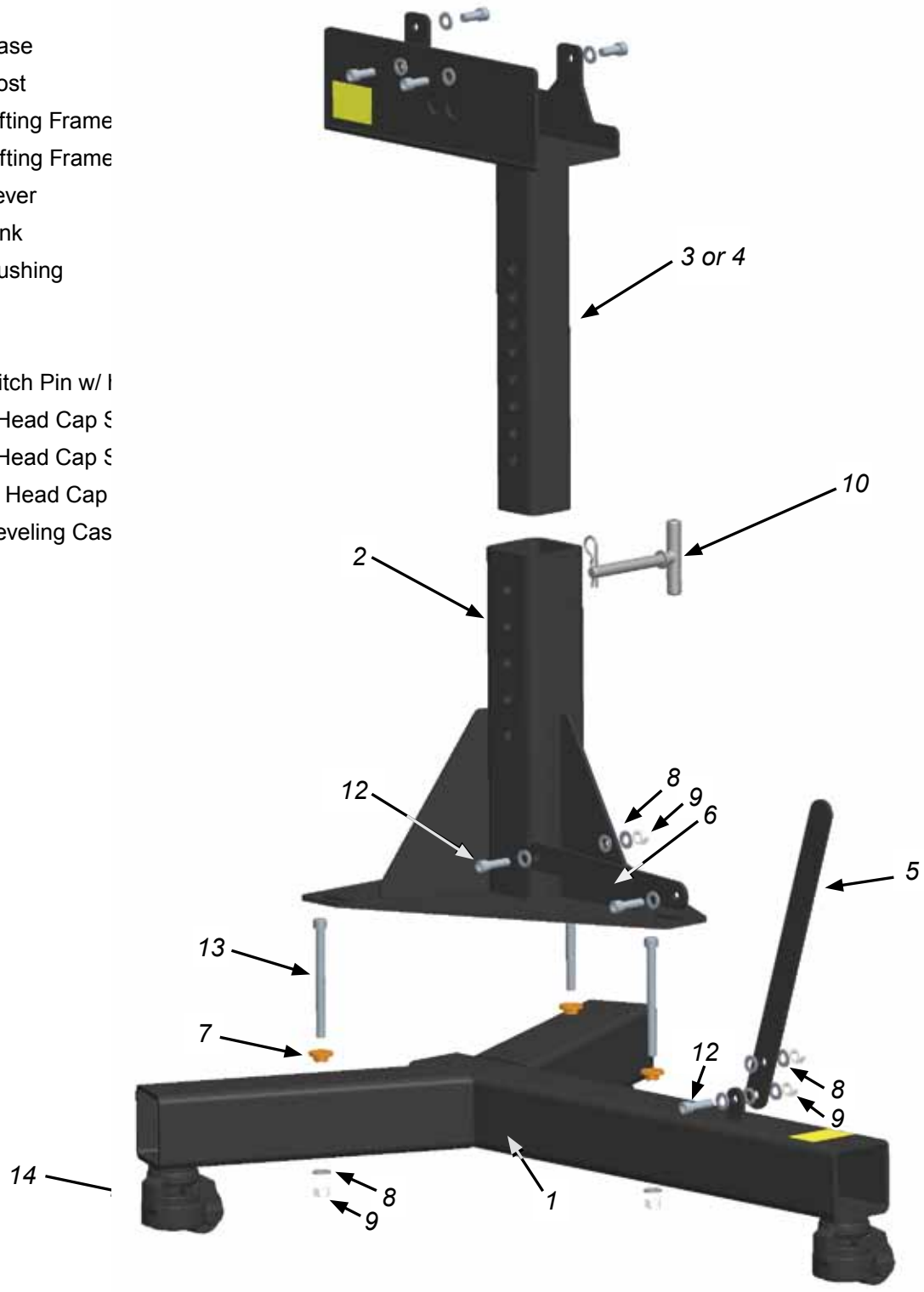


Figure 36: E60/E60X Stand Components

E490/490X Components

1. AIUM1000294 Base
2. AIUM1000295 Post
3. AIUM1000296 Lifting Frame
4. AIUM1000297 Lifting Frame
5. AIUM1000325 Lever
6. AIUM1000282 Link
7. AIUM1000326 Bushing
8. M12 Washer
9. M12 Nylock Nut
10. AIUM1000290 Hitch Pin w/ H
11. M12X30 Socket Head Cap S
12. M12X40 Socket Head Cap S
13. M12X160 Socket Head Cap
14. AIUM1000284 Leveling Cas

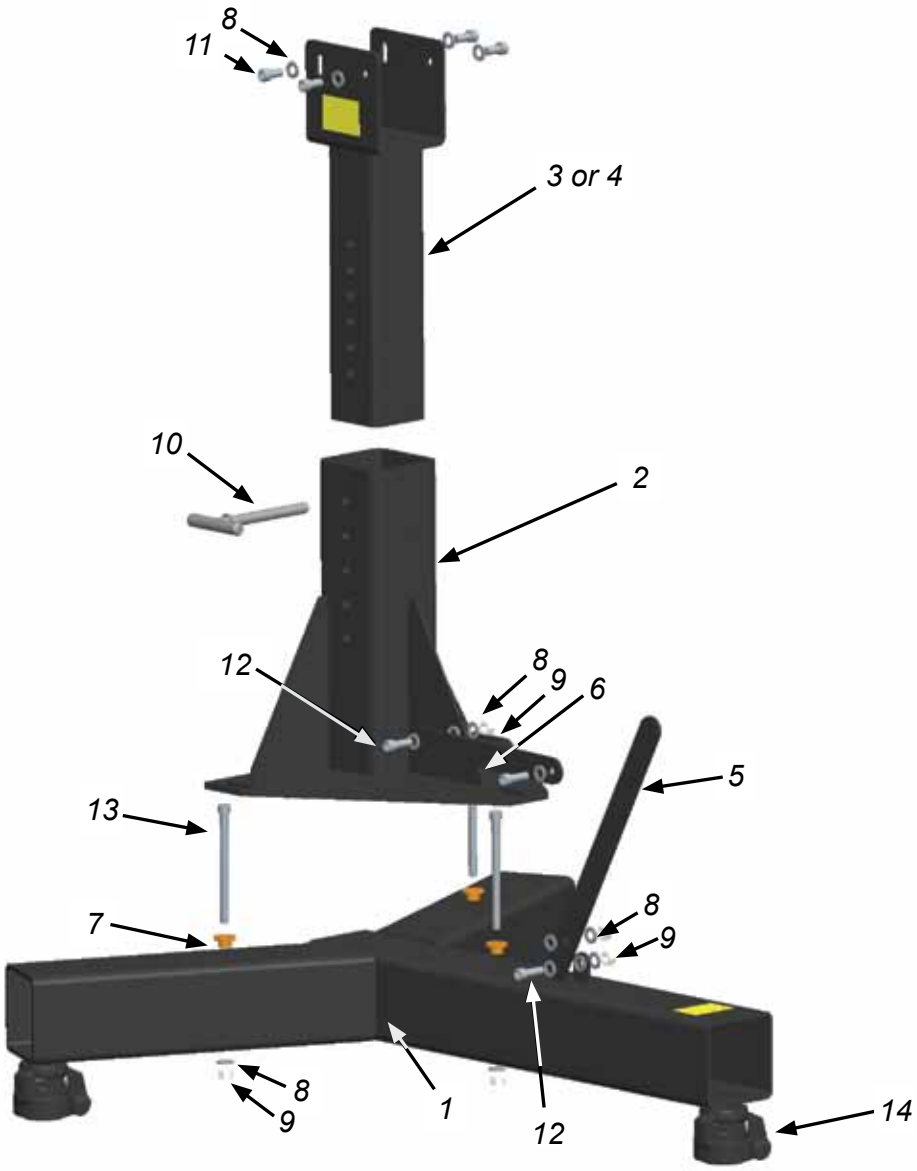


Figure 37: E490/E490X Stand Components

Sizes Available

Part Number	Description	Height Range [mm]
AIUM1000300	E60/E60X Compact Stand, 1040-1300	1040-1300
AIUM1000301	E60/E60X Compact Stand, 1240-1500	1240-1500
AIUM1000302	E490/E490X Compact Stand, 1100-1300	1100-1300
AIUM1000303	E490/E490X Compact Stand, 1300-1500	1300-1500

Figure 38: E60/E60X Compact Stand

Figure 39: E490/E490X Compact Stand

Leveling Mounts

Leveling pad fully extended

Figure 40: Leveling Pad Extended

Leveling pad fully retracted

Figure 41: Leveling Pad Retracted

Assembly

1. Adjust compact stand to desired height using the coarse adjustments. See Tables 1-4 on the next page for pin hole positions.

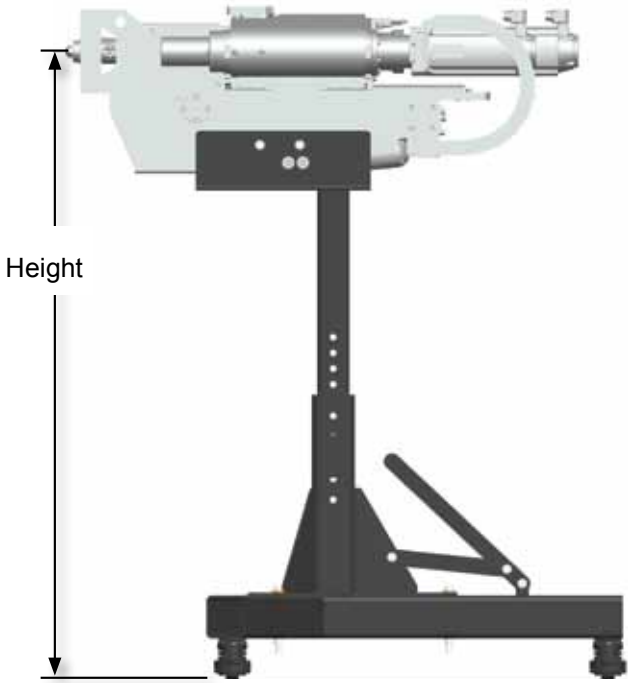


Figure 42: Measuring Stand Height

2. Ensure stand horizontal adjustment is in the forward position (push lever toward injection molding machine). See *"Horizontal Position Adjustment" on page 12-8*.
3. Assemble the mold adapter plate to the E-Multi unit.
4. Attach the crane support to the E-Multi unit per *"Lifting the AIU" on page 10-8*. Using the crane, lower the E-Multi unit with the mold adapter plate onto the stand and hand tighten the stand to the unit with provided M12 bolts and washers.

CAUTION
Make sure cables and tubing are not pinched during assembly.

5. With the crane still attached, move the unit with the stand to mate with the mold and fasten the mold adapter plate to the mold (refer to torque chart).

CAUTION
Do not move the stand with the unit without crane support.

6. Torque M12 bolts to specified torque (refer to torque chart).
7. For the E490/E490X model, tilt the E-Multi unit using the crane until the unit is leveled then torque the M12 bolts to specification.
8. Adjust the 3 leveling mounts so that they are compressed (15mm available fine adjustment).
9. Release the crane support.

Alternate Method

1. Adjust compact stand to desired height using the coarse adjustments.
2. See tables 1-4 on next page for pin hole positions.
3. Ensure horizontal adjustment is in the back position (push lever away from injection molding machine). See *"Horizontal Position Adjustment" on page 12-8*.
4. Assemble the mold adapter plate to the E-Multi unit.
5. Attach the crane support to the E-Multi unit per *"Lifting the AIU" on page 10-8*.
6. Using the crane, lower the E-Multi unit with the mold adapter plate onto the stand and fasten with provided M12 bolts and washers per torque chart.

CAUTION
Make sure cables and tubing are not pinched during assembly.

7. For the E490/E490X model, tilt the E-Multi unit using the crane until the unit is leveled then torque the M12 bolts to specification.
8. With the crane still attached, position the stand adjacent to the machine so that the mold adapter plate is within 50mm of the mold.

CAUTION
Do not move the stand with the unit without crane support.

9. Adjust the leveling mounts to align the E-Multi unit vertically to the mold (15mm fine adjustment).
10. Release the crane support.
11. Push the lever forward (towards the machine) to mate the mold adapter plate to the mold.
12. Fasten the mold adapter plate to the mold per torque chart.
13. Readjust the leveling mounts, if necessary.

Height Adjustment

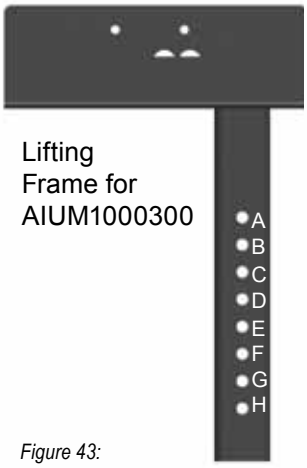


Figure 43:

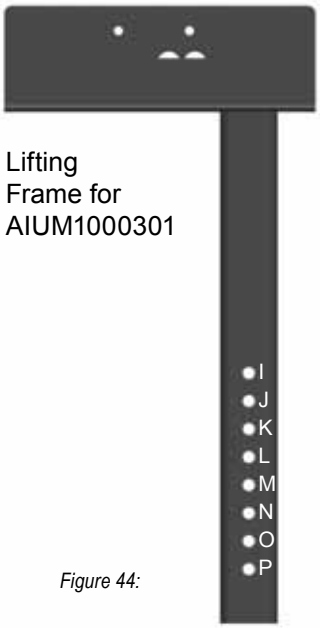


Figure 44:

Figure 45:

Table 1: AIUM1000300		
Nozzle Height (mm)	**Lifting Frame Hole Position**	**Post Hole Position**
1037.5	C	4
1050	B	3
1062.5	A	2
1075	D	4
1087.5	C	3
1100	B	2
1112.5	A	1
1125	D	3
1137.5	C	2
1150	B	1
1162.5	E	3
1175	D	2
1187.5	C	1
1200	F	3
1212.5	E	2
1225	D	1
1237.5	G	3
1250	F	2
1262.5	E	1
1275	H	3
1287.5	G	2
1300	F	1

Table 2: AIUM1000301		
Nozzle Height (mm)	**Lifting Frame Hole Position**	**Post Hole Position**
1237.5	K	4
1250	J	3
1262.5	I	2
1275	L	4
1287.5	K	3
1300	J	2
1312.5	M	4
1325	L	3
1337.5	K	2
1350	J	1
1362.5	M	3
1375	L	2
1387.5	K	1
1400	N	3
1412.5	M	2
1425	L	1
1437.5	O	3
1450	N	2
1462.5	M	1
1475	P	3
1487.5	O	2
1500	N	1

Lifting Frame for AIUM1000302

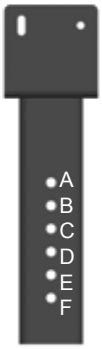


Figure 46:

Lifting Frame for AIUM1000303

Figure 47:

Figure 48:

Table 3: AIUM1000302		
Nozzle Height (mm)	**Lifting Frame Hole Position**	**Post Hole Position**
1100	D	5
1112.5	C	4
1125	B	3
1137.5	A	2
1150	D	4
1162.5	C	3
1175	B	2
1187.5	A	1
1200	D	3
1212.5	C	2
1225	B	1
1237.5	E	3
1250	D	2
1262.5	C	1
1275	F	3
1287.5	E	2
1300	D	1

Table 4: AIUM1000303		
Nozzle Height (mm)	**Lifting Frame Hole Position**	**Post Hole Position**
1300	J	5
1312.5	I	4
1325	H	3
1337.5	G	2
1350	J	4
1362.5	I	3
1375	H	2
1387.5	G	1
1400	J	3
1412.5	I	2
1425	H	1
1437.5	K	3
1450	J	2
1462.5	I	1
1475	L	3
1487.5	K	2
1500	J	1

Horizontal Position Adjustment

Figure 49: Horizontal Position Level Forward

Figure 50: Horizontal Position Level Back

Mold Removal

1. Remove the bolts fastening the adapter plate to the mold.
2. Pull the lever fully back (away from the machine).
3. Remove mold.

Mold Installation

1. Push the lever forward (towards the machine) to mate the mold adapter plate to the mold.
2. If necessary, adjust the leveling mounts to align the E-Multi unit vertically to the mold (15mm fine adjustment).
3. Fasten the mold adapter plate to the mold per torque chart.

Torque Specifications

Nominal Thread Size	Nm	Ft-lbs
4	4.6	3.4
5	9.5	7
6	16	11.5
8	39	29
10	58	42.5
12	101	75
14	161	119
16	248	181.5

Disassembly

1. Remove the bolts fastening the adapter plate to the mold.
2. Pull the lever fully back (away from the machine).
3. Attach the crane support to the E-Multi unit per *"Lifting the AIU" on page 10-8*.
4. With the crane, roll the assembly away from the machine.
5. Remove bolts fastening the stand to the E-Multi unit.
6. With the crane, lift the E-Multi unit up and away from the stand.

Appendix A - Euromap 67

Scope and Application

This EUROMAP 67 recommendation defines the connection between the injection molding machine and the handling device / robot. This is intended to provide interchangeability. In addition recommendations are given for signal voltage and current levels.
Please note that the risk assessment for the movements of the handling device / robot mostly require redundancy which is achieved by two channels on Table 1: ZA3, ZC3 and ZA4, ZC4 on the injection molding machine. EUROMAP 12 shall therefore only be applied for replacement purposes on existing equipment.

Description

The signals in both the injection molding machine and the handling device / robot are given by contacts, e.g. contacts of relays or switches, semiconductors, etc. The contact making is either potential-free or related to a reference potential supplied to a contact of the plug mounted on the injection molding machine or the handling device / robot (see Tables 1 and 2). All signals which are not optional shall be supported by all injection molding machines and handling devices / robots.

Plug and socket outlet

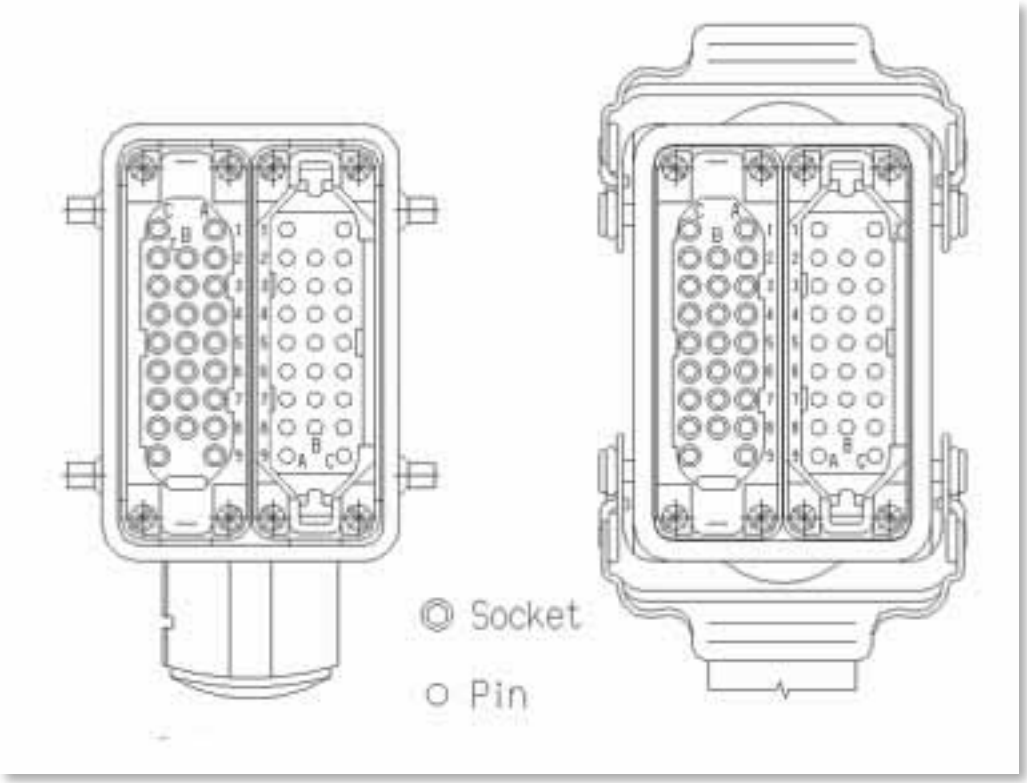


Figure 51: Plug on Handling Device (Left) Plug on Injection Molding Machine (Right)

The connection between the injection molding machine and the handling device / robot is achieved by the plugsspecified below. For the injection molding machine and the handling device / robot the plug contacts should be capable of taking a minimum of 250 V and 10 A. See *"Figure 51: Plug on Handling Device (Left) Plug on Injection Molding Machine (Right)" on page A-i* arrangement of pins and sockets viewed from the mating side (opposite the wiring side).

Table 1: Plug on the injection molding machine

Signals from the injection molding machine to the handling device / robot

Contact No (male)	Signal designation	Description
ZA1 ZC1	Emergency stop of machine channel 1	The switch contact must be open when the injection molding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
ZA2 ZC2	Emergency stop of machine channel 2	The switch contact must be open when the injection molding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
ZA3 ZC3	Safety devices of machine channel 1	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection molding machine are operative so that dangerous movements of the device / robot are possible. The signalis active in operation mode. The signal must be the result of limit switch contact series of mold area safety devices according to EN 201.
ZA4 ZC4	Safety devices of machine channel 2	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection molding machine are operative so that dangerous movements of the handling device / robot are possible. The signal is active in any operation mode. The signal must be the result of limit switch contact series of mold area safety devices according to EN 201.
ZA5	Reject	HIGH signal when the molding is a reject. HIGH signal when the mold is open and must remain HIGH at least until "Enable mold closure" Optional (see table 2: handling device / robot signals contact No A6.). It is recommended to have HIGH signal already when the mold opening starts.
ZA6	Mold closed	HIGH signal when the mold closing is completed. Note: The signal "Enable mold closure" is then no longer required (see table 2: handling device / robot signals contact No A6).
ZA7	Mold open position	HIGH signal when mold opening position is equal or more than required position. Inadvertent alteration to mold opening stroke smaller than that required for the handling device / robot to approach must be impossible. The signal must remain HIGH as long as the mold is open and must not be interrupted by a change of operation mode or safety guard opening.
ZA8 Optional	Intermediate mold opening position	HIGH signal when mold opening reaches a set position smaller than mold opening position (see table 1: injection molding machine signals contact No ZA7). The signal remains HIGH to the end of mold opening position. Two sequences are possible with this signal: a) Mold opening stops on intermediate position and gives start signal to handling device / robot. Mold opening restarts with the signal "Enable full mold opening" (see table 2: handling device / robot signals contact No A7). b) Mold opening does not stop on intermediate position, however gives the signal to handling device / robot. At this sequence the signals " Enable full mold opening" (see table 2: A7) and "Mold area free" (table2: A3/C3) are not in use. LOW signal when intermediate mold opening position is not in use.

Contact No (male)	Signal designation	Description
ZA9	Supply from handling device / robot	24 V DC (Reference potential)
ZB2	Enable operation with handling device / robot (Automatic)	HIGH signal when the injection molding machine is able to be operated with handling device / robot. This signal shall not be used to start the handling device / robot. If the signal turns LOW during the operation mode of the handling device / robot "operation with injection molding machine", it is recommended that the handling device / robot continues its automatic cycle until the end position.
ZB3	Ejector back position	HIGH signal when the ejector has been finally (e.g. after the number of its set cycles) retracted regardless of the moving platen position. The signal is the acknowledgement for the "Enable ejector retraction" signal (see table 2: handling device / robot signals contact No B3), when the ejector sequence is selected. It is recommended to have HIGH signal when the ejector sequence is not in use.
ZB4	Ejector forward position	HIGH signal when the ejector has been advanced. The signal is the acknowledgement signal for the "Enable ejector advance, (see table 2: handling device / robot signals contact No B4). It is recommended to have HIGH signal when the ejector sequence is not in use.
ZB5 Optional	Core pullers 1 in position 1 (Core pullers 1 free for handling device / robot to approach)	HIGH signal when the core pullers 1 are in position 1 (see table 2: handling device / robot signals contact No B5). It is recommended to have LOW signal when the core puller sequence is not in use.
ZB6 Optional	Core pullers 1 in position 2 (Core pullers 1 in position to remove molding)	HIGH signal when the core pullers 1 are in position 2 (see table 2: handling device / robot signals contact No B6). It is recommended to have LOW signal when the core puller sequence is not in use.
ZB7 Optional	Core pullers 2 in position 1 (Core pullers 2 free for handling device / robot to approach)	HIGH signal when the core pullers 2 are in position 1 (see table 2: handling device / robot signals contact No B7). It is recommended to have LOW signal when the core puller sequence is not in use.
ZB8 Optional	(Core pullers 2 in position to remove molding)	HIGH signal when the core pullers 2 are in position 2 (see table 2: handling device / robot signals contact No B8).It is recommended to have LOW signal when the core puller sequence is not in use.
ZC5		Reserved for future use of EUROMAP
ZC6		Reserved for future use of EUROMAP
ZC7		Reserved for future use of EUROMAP
ZC8		Not fixed by EUROMAP, manufacturer dependent
ZC9	Supply from handling device / robot	0 V (Reference potential)

Table 2: Plug on the injection molding machine

Signals from the handling device / robot to the injection molding machine

Contact No (female)	Signal designation	Description
A1 C1	Emergency stop of handling device / robot Channel 1	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection molding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A2 C2	Emergency stop of handling device / robot Channel 2	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection molding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A3 C3	Mold area free	The switch contact is closed when the handling device / robot is outside the mold area and does not interfere with mold opening and closing movements. The switch contact must be opened when the handling device / robot leaves its start position. If the switch contact is open neither opening nor closing of the mold may occur. However the injection molding machine may ignore this signal when mold opening is carried out after e.g. an intermediate stop (see table 1: injection olding machine signals contact No ZA8), if the optional sequence is selected on the injection molding machine. The signal must have the described effect even when the handling device / robot is switched off. It is recommended to close the switch contact when the handling device / robot is unselected.
A4 C4		Reserved for future use by EUROMAP
A5		Not fixed by EUROMAP, manufacturer dependent
A6	Enable mold closure	HIGH signal when the handling device / robot is retracted enough for start of mold closure. The signal must remain HIGH at least until "Mold closed" (see table 1: injection molding machine signals contact No ZA6) is available. If the signal is LOW as a result of a fault, mold closing must be interrupted. The signal "Enable mold closure" must not be a logical "or" with either other signals, e.g. "Close safety guard" or a push button in any operation mode. The signal must be HIGH if the handling device / robot is switched off. It is recommended to have HIGH signal when the handling device / robot is unselected.
A7 Optional	Enable full mold opening	HIGH signal when the handling device / robot has taken the part and allows to continue mold opening. The signal must remain HIGH until "Mold open" signal is given by the injection molding machine (see table 1: injection molding machine signals contact No ZA7).
A8		Reserved for future use by EUROMAP
A9	Supply from injection molding machine	24V DC / 2A (Reference potential)

Contact No (female)	Signal designation	Description
B2	Handling device / robot operation mode (operation with handling device / robot)	LOW signal when the handling device / robot mode switch is "Operation with injection molding machine". HIGH signal when the handling device / robot mode switch is "No operation with injection molding machine". HIGH signal when the handling device / robot is switched off.
B3	Enable ejector back	HIGH signal when the handling device / robot enables the movement for ejector back. The signal must remain HIGH at least until "Ejector back" signal is given by injection molding machine (see table 1: injection molding machine signals contact No ZB3).
B4	Enable ejector forward	HIGH signal when the handling device / robot enables the movement for ejector forward. The signal must remain HIGH at least until "Ejector forward" signal is given by the injection molding machine (see table 1: injection molding machine signals contact No ZB4).
B5 Optional	Enable movement of core pullers 1 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 1" signal is given by injection molding machine (see table 1: injection molding machine signals contact No ZB5). The signal shall remain at least until position 2 has been left. (see table 1: injection molding machine signals contact No ZB6).
B6 Optional	Enable movement of core pullers 1 to position 2 (Enable core pullers 1 to remove the molding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 2" signal is given by injection molding machine (see table 1: injection molding machine signals contact No ZB6). The signal shall remain at least until position 1 has been left. (see table 1: injection molding machine signals contact No ZB5).
B7 Optional	Enable movement of core pullers 2 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 1" signal is given by injection molding machine (see table 1: injection molding machine signals contact No ZB7). The signal shall remain at least until position 2 has been left. (see table 1: injection molding machine signals contact No ZB8).
B8 Optional	Enable movement of core pullers 2 to position 2 (Enable core pullers 2 to remove the molding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 2" signal is given by injection molding machine (see table 1: injection molding machine signals contact No ZB8). The signal shall remain at least until position 1 has been left. (see table 1: injection molding machine signals contact No ZB7).
C5		Not fixed by EUROMAP, manufacturer dependent
C6		Reserved for future use by EUROMAP
C7		Reserved for future use by EUROMAP
C8		Not fixed by EUROMAP, manufacturer dependent
C9	Supply from injection molding machine	0V (Reference potential)

Index

M

N

O

P

R

S

T

U

V

W

www.moldmasters.com

Mold Masters®
performance delivered