



aerospace
& simulation

Control Loading for Simulation

Control Loading Technology
Turnkey Solutions
System Development
and Design



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Global Locations with Local Support and Superior Quality

Bringing a legacy of precision mechanical components combined with highly dynamic brushless servo technology, Wittenstein creates solutions that move the future of simulation. Our designers and engineers not only have **passion** in what they do, they also take **pride** in working to **develop** solutions which partners require - providing confidence, reliability and realism to customers of its systems.

With research, design and manufacturing capabilities in Europe and North America, Wittenstein supports motion globally and locally.

Every day is a new opportunity for Wittenstein to work with you to create solutions for the future of motion.

WITTENSTEIN – being **one with the future**

A Decade of Moving Aerospace and Simulation with Haptic Technology

Wittenstein Aerospace & Simulation is the world leader in design, development and production of control loading technology for the aerospace and simulation markets.

Its solutions are based on:

- Integrated, high-performance servo motors and planetary gearboxes
- State-of-the-art integrated control electronics
- WA&S re-configurable software that provides dynamically adjustable force-feel characteristics

Working closely with customers, we create relationships built on trust and mutual values. Together, we develop a future focused on solutions for the requirements of a constantly evolving market.

Wittenstein Aerospace & Simulation celebrates 10 years as a member of the Wittenstein Group of high technology companies. Global innovations of Wittenstein include:

- The first servo planetary gear reducer
- Sensor integration into motion components
- The compact control loading system for simulators

Experience the outstanding service of Wittenstein Aerospace & Simulation as we continually work toward exceeding expectations - creating unprecedented possibilities that open up a world of development opportunities for your project.



The WITTENSTEIN Philosophy

Innovation
A legacy of cutting-edge technology

- Developed the first high-fidelity drop-in modules
- Leading design and development of simulation and aerospace systems into the 21st Century

Responsibility
Project ownership through

- Requirements definition
- Design
- Installation
- Certification
- Validation

Change
Promoting market need awareness

- Flexibility inherent in systems and ideology
- Providing a full range of products
- Dedicated configuration management to handle changes over the life of the program

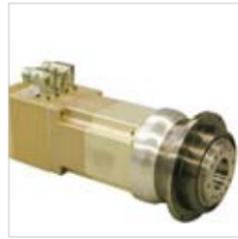
Openness
Providing solutions with relationships

- Turnkey solutions
- Easy system integration with simple protocol
- Reduced customer risk and effort

Trust
Building a better future based on mutual values

- Providing the most reliable and stable systems and products
- Working closely with partners to develop solutions which will lead the market into the future

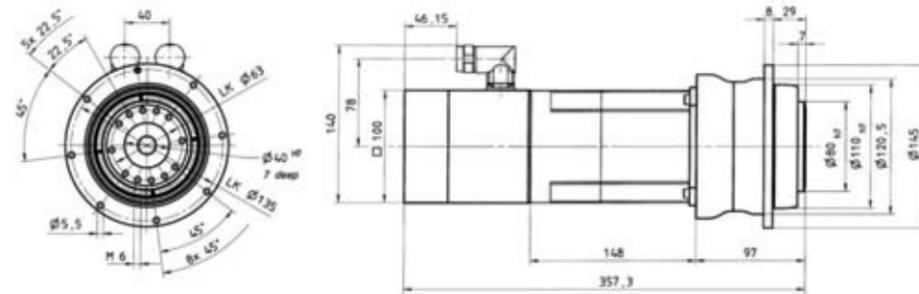




Size 025

The size 025 control loading actuator can be provided in an inline or L-shaped version to meet the space envelope needs as well as being located close to the controls. This actuator can be used as a hydraulic actuator replacement as well as for pedal axes.

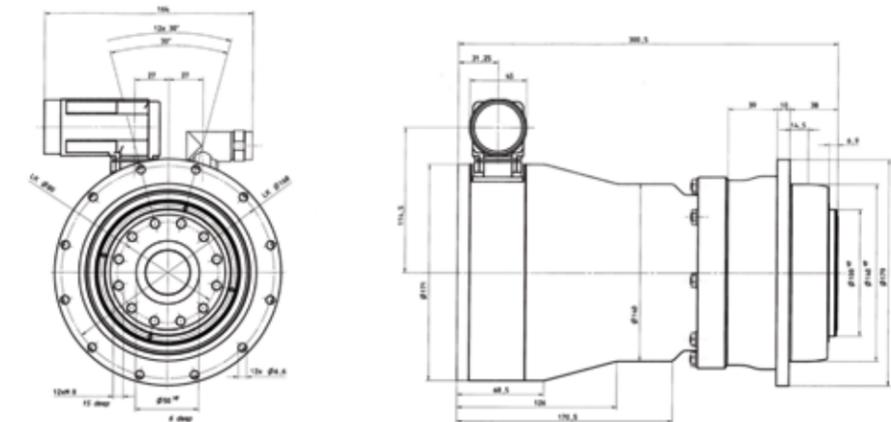
Ratio	i		31		40		61		91	
DC Bus Voltage	U_D	VDC	28	48	28	48	28	48	28	48
Maximum Torque	T_{max}	Nm	171	176	221	227	337	346	503	516
Maximum Speed	$n@T_{max}$	rpm	16	57	12	44	8	29	5	19
No load Speed	n_0	rpm	34	88	26	69	17	45	12	30
Nominal Torque	T_n	Nm	95	92	122	119	187	182	279	271
Nominal Speed	n_n	rpm	19	63	14	49	9	32	8	22
Backlash	J_t	arcmin	< 6							



Size 050

The size 050 control loading actuator is the largest actuator provided for control loading. As examples, this actuator can be used for column, pedals and centerstick axes.

Ratio	i		31	40	61	91
DC Bus Voltage	U_D	VDC	48			
Maximum Torque	T_{max}	Nm	385	496	757	1129
Maximum Speed	$n@T_{max}$	rpm	32	25	16	11
No load Speed	n_0	rpm	52	41	27	18
Nominal Torque	T_n	Nm	218	281	429	640
Nominal Speed	n_n	rpm	40	31	20	14
Backlash	J_t	arcmin	< 6			





The RAMT (Re-configurable Aircraft Mission Trainer) is an integrated flight control system incorporating standard Wittenstein control loading devices. The configuration allows users to create a system using any combination of sidestick, centerstick, linear throttle, rotary throttle and rudder pedals to meet unique project requirements. Alternatively, the user can select from our modular control loading actuators and attach to existing linkage mechanisms to create a specific fixed wing control loading system.

Each system also includes the Wittenstein System Control Module (SCM), the Aktiv8® application software, System Power Supply (SPS) and appropriate cabling. The Wittenstein Aktiv Toolkit can also be added to provide system set-up and diagnostic capabilities.

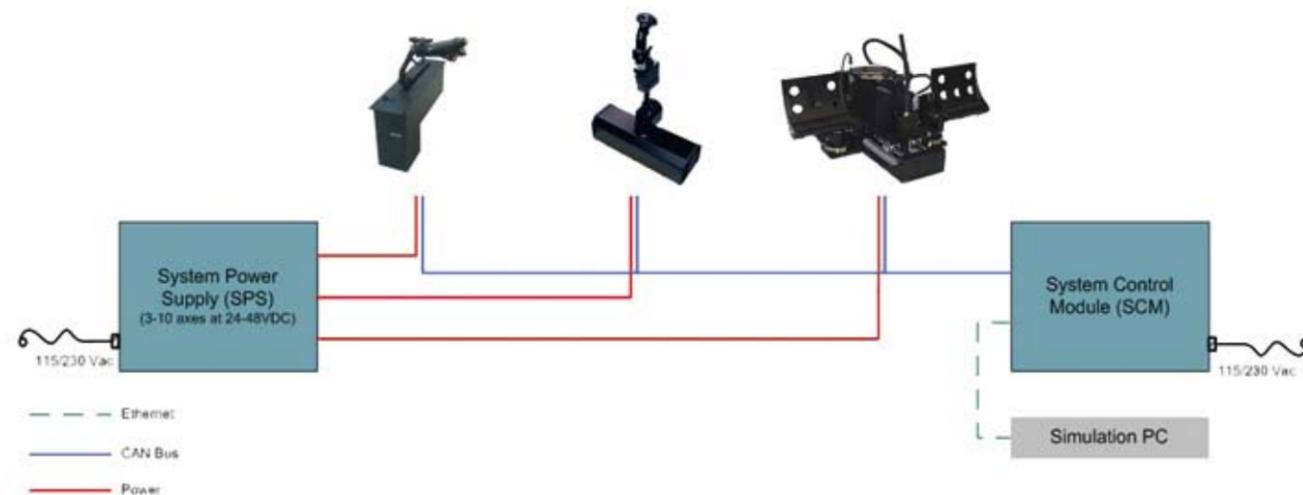
The grips for the devices can be provided by Wittenstein or supplied by the customer.

The Wittenstein RAMT control loading devices use integrated motor gearbox actuators with intelligent control electronics. These actuators communicate over a CAN bus with the SCM, which provides system control functions and an interface to the host computer via an Ethernet connection.

Each of the devices has a standard set of configuration files that are stored on the SCM and determine the characteristics of the device. The Wittenstein Aktiv Toolkit can be used to create additional configuration files to suit particular requirements.

Features

- Individual control loading devices for the sidestick, centerstick, linear throttle, rotary throttle and rudder pedals
- CAN bus communications between the SCM and the intelligent actuator control electronics modules
- Options for single or twin seat cockpits with electric linking of axes
- Ethernet communications (TCP/IP or UDP) with the host
- An optional Windows® graphical user interface (GUI) set-up and diagnostics program, the Aktiv Toolkit
- An SPS that provides all system power with optional emergency stop and RS232 communications



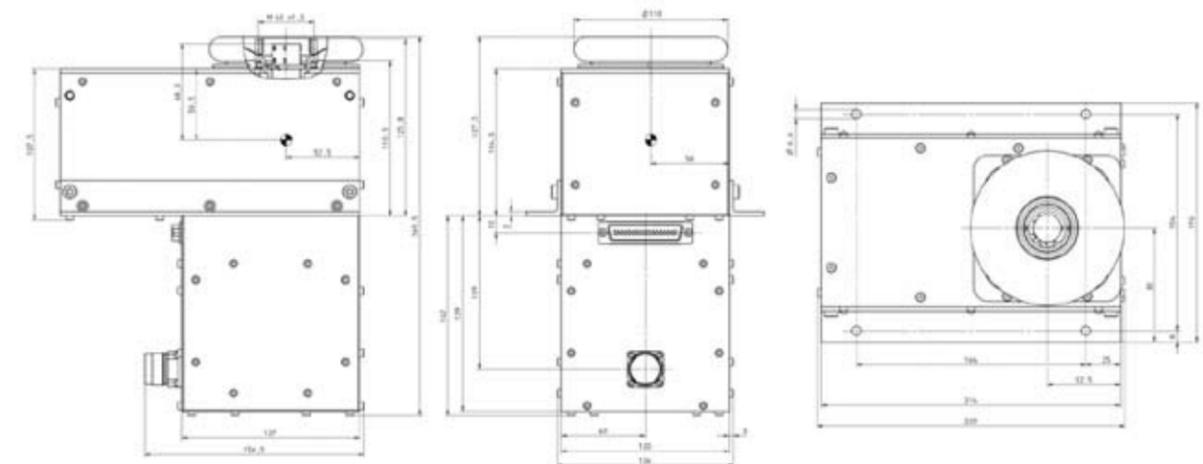
The sidestick has integrated motors, gearboxes, control loading electronics and force sensor technology.

The following specifications are based on the standard gear ratio. Gear ratios can be changed to adjust the maximum torque to meet application requirements.

Features

- Independent pitch and roll axes with high fidelity brushless DC motors with integrated control electronics
- Compact configuration
- Easily mountable with bolt down fixing to the cockpit frame
- CAN bus interface for actuator control from the SCM
- Built-in force sensor
- Realistic grip with full switch fidelity and functionality (optional)

		Max. Continuous	Peak
Torque	Nm (in.lb)	24 (212)	58 (510)
Force at GRP of 8 inches	N (lb)	116 (26)	280 (63)
		Minimum	Maximum
Travel	Deg	-18	18
Travel at GRP of 8 inches	inches	-2.5	2.5





The active centerstick for simulation integrates motor, gearbox, control loading electronics and force sensor into a compact and efficient design.

The following specifications are based on the standard gear ratio. Gear ratios can be changed to adjust the maximum torque to meet application requirements.

Features

- Independent pitch and roll axes with high fidelity brushless DC motors with integrated control electronics
- Compact configuration (cable entries on the side are within its space envelope)
- Easily mountable with bolt down fixing to the cockpit frame
- CAN bus interface for actuator control from the SCM
- Built-in force sensor
- Modular – can be easily reengineered to change paddle box, roll axis pivot point and GRP to suit the particular application
- Realistic grip with full switch fidelity and functionality (optional)

Center Stick Pitch		Max. Continuous	Peak
Torque	Nm (in.lb)	48.3 (427.5)	82.2 (727.5)
Force at GRP of 18.5 inches	N (lb)	102.8 (23.1)	174.9 (39.3)
		Minimum	Maximum
Travel	Deg	-7.5	13.9
Travel at GRP of 18.5 inches	inches	-2.4	4.5

Center Stick Roll		Max. Continuous	Peak
Torque	Nm (in.lb)	24.1 (213.3)	56.6 (501)
Force at GRP of 16 inches	N (lb)	59.3 (13.3)	139.3 (31.3)
		Minimum	Maximum
Travel	Deg	-14	14
Travel at GRP of 16 inches	inches	-3.9	3.9



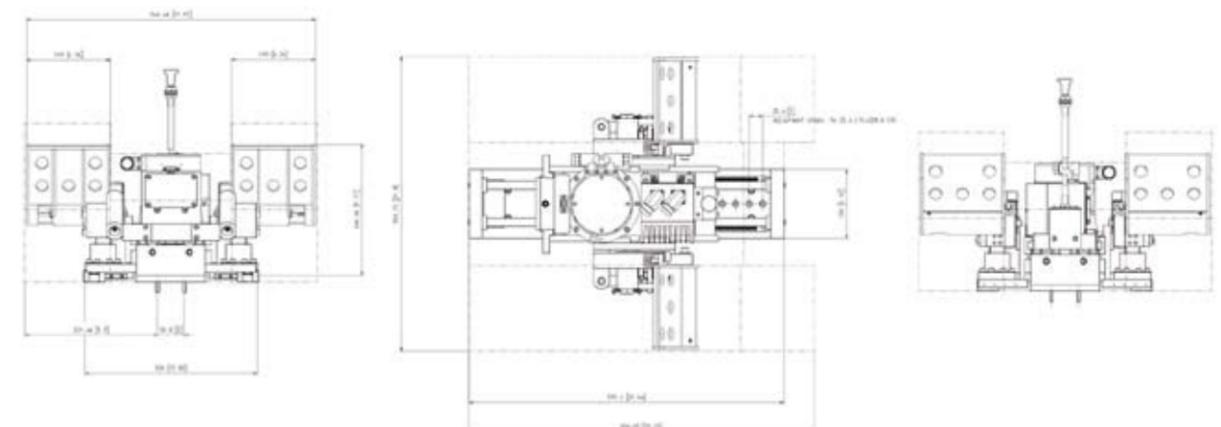
The active rudder pedal assembly is a combination of one integrated control loading actuator consisting of motor, gearbox and electronics, force sensors and pedal arrangement. The pedal arrangement can provide linear or rotary motion of the pedals and integrated toe brakes.

The following specifications are based on the standard gear ratio. Gear ratios can be changed to adjust the maximum torque to meet application requirements.

Features

- High fidelity brushless DC motor with integrated control electronics
- Bolt down fixing to the cockpit structure
- CAN bus interface for actuator control from the System Control Module
- Linear or rotary motion
- Built-in force sensors
- Toe brake potentiometers (optional)
- Adjustable position (optional)

		Max. Continuous	Peak
Torque	Nm (in.lb)	154.7 (1369.2)	173 (1531.2)
Force at GRP of 8 inches	N (lb)	761.3 (171.1)	851.4 (191.4)
		Minimum	Maximum
Travel at GRP of 8 inches	inches	-3.25	3.25



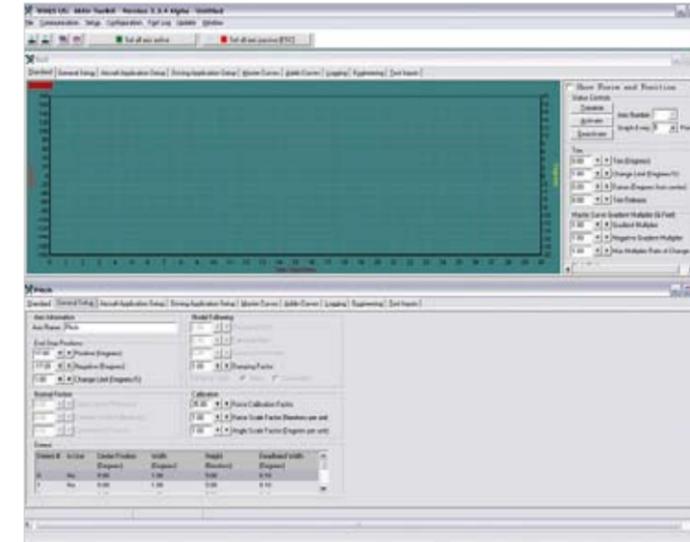
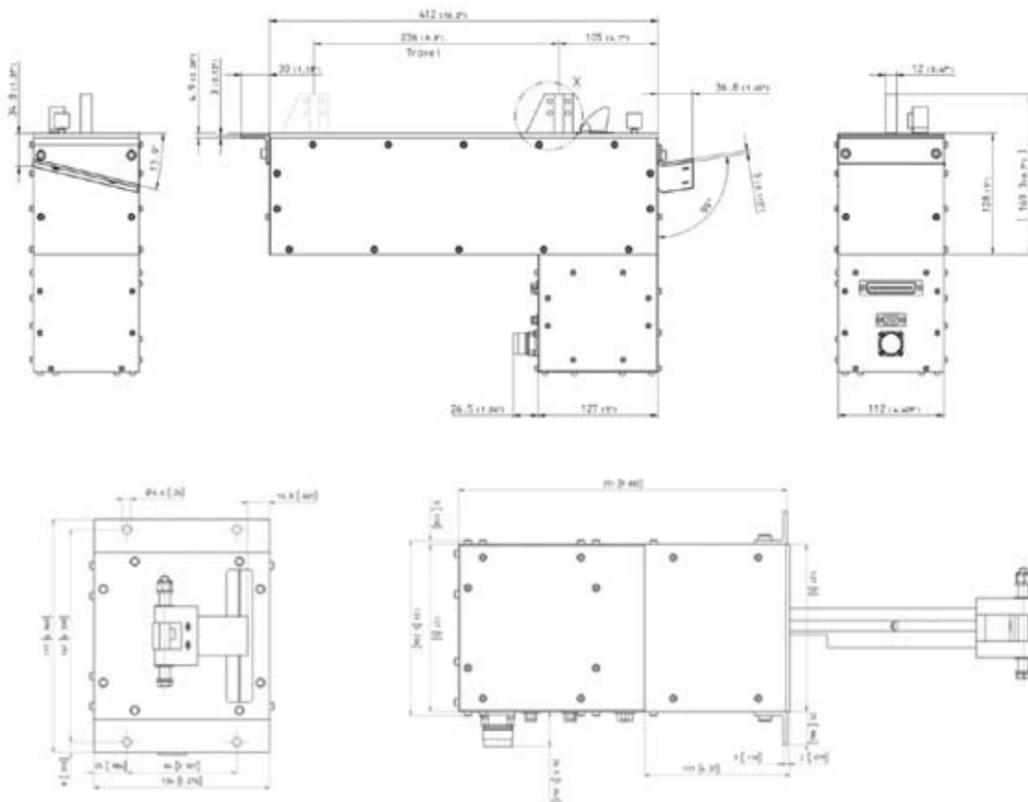


The active linear and rotary throttles are a combination of a single control loading actuator with linear or rotary gearing, electronics and force sensor. Dual throttle variants are also available.

The linear throttle provides a friction adjust knob and active/passive switch on the top surface to represent the F-35. The dual rotary variants can optionally have friction adjust levers which provide feedback to the system to electrically adjust the friction of the levers.

Throttle grips can be provided to suit the aircraft model.

Given data refer to the linear throttle variant		Max. Continuous	Peak
Force at GRP of 11 inches	N (lb)	105.6 (23.7)	354.4 (79.7)
		Minimum	Maximum
Travel at GRP of 23 inches	inches	-4.64	4.64



Aktiv8® is a software program which runs in real time on the System Control Module (SCM). It utilizes the configuration file set to define the device characteristics and also controls the communications with the host.

This software is the core of the control loading system and ensures a highly dynamic and responsive control loading system with precise characteristics to accurately represent any aircraft.

Wittenstein's Aktiv8® application software is made up of the Aktiv8® control software and the configuration file set.

The force-feel characteristics, dynamic response characteristics and programmable features of the control loading devices are set by means of data values and look-up tables held in a set of files that are known as the "configuration file set".

The configuration file set is made up of one primary configuration file, Master Curve files, Add-in files and other characteristics files.

In addition, there is an option to provide project specific functionality using the Aktiv8® DLM. This can be written in C or autocoded from MATLAB Simulink.

Features

- Defines the force-feel characteristics, dynamic response characteristics and programmable features of the system
- Contains the configuration file set which includes:
 - Force feel curves
 - Application specific parameters

The Aktiv Toolkit is the graphical user interface supplied with the control loading system. This is used for maintenance and set-up of the control loading system. The Aktiv Toolkit is easily installed on any PC with a USB port and running Microsoft Windows® 2000 or XP.

It is used to develop configuration files as well as test, monitor and set-up the system.

The 3 editions of the Aktiv Toolkit are:

- Standard Edition including basic monitoring, trimming and axis oscilloscope functions
- System Set-Up Edition including the Standard edition plus all set-up, calibration, force-position characteristic viewing and logging functions
- Analyst Edition including the System Set-up edition plus frequency response test inputs and rapid logging of data

The software is also supplied on a CD with all the documentation required to install, set up and maintain the Wittenstein Control Loading System.



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