User group oriented argumentation guideline for the sales force

Linear module ELP

08/2016

Creator: P. Zuber

Nutzergruppenorientierte Argumentationshilfe ELP

Target customer: Machine Builder

User group: Purchasing

Technical feature	Benefit	Customer value		Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
24 V Power Supply	24 V power supply already available in many assembly machines (e.g. for sensors)	No extra components, as e.g. converter or controller, needed. ➔ **Saving of purchasing cost** Electric standard-periphery (cable, distributor, …) can be used. ➔ **High standardization rate**		Minimum 2 energy sources necessary for pneumatic components ➔ **Higher purchasing costs and efforts**	Due to missing standards, various modules often need different levels of voltage within the same machine. Extra components, e.g. converter or controller, need to be used. Additionally, there is always a specific periphery necessary ➔ **Higher purchase costs and low standardization**
Standardized connections	Standard cables and distributors from different manufacturers can be used	Customer can order at his preferred supplier to his customized conditions. Only few new parts ➔ **Low costs and efforts**		Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controller are used. Also the cables are often specific for each module and are often specific for each module and are not standardized. So the customer is tied to the cable manufacturer. ➔ **High purchasing costs and efforts**

Target customer: Machine Builder

User group: Project manager

Technical feature	Benefit	Customer value		Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
24 V Power Supply	Voltage is in low voltage range	Other protection class according to the norm, therefore the necessary and legal safety arrangements for the machine are definitely lower. ➔ **Less efforts and costs**		In pneumatics, there is generally no high voltage necessary as well ➔ **No difference in the level of voltage**	Many controller and modules work by an intermediate circuit voltage up to 560 V, which causes higher safety measures. ➔ **Higher costs and efforts**
Actuation with digital signals (I/O)	Communication is working from the PLC control directly to the modules	No extra components (e.g. controller/ valves) necessary. Therefore more space in the control cabinet ➔ **Saving of costs and space**		The customer additionally needs valves for actuating pneumatic components. These are placed on the valve terminal, which also requires space. ➔ **More required space**	The customer additionaly need one controller in the control cabinet for each module or a particular communication protocol ➔ **Higher purchase cost and required space in the control cabinet**
	No complex programming necessary --> easy commissioning	Fast commissioning No or rather little know-how in software engineering necessary ➔ **Saving of costs and space**		In the pneumatics, the valve is actuated with digital I/O. ➔ **No difference**	For the definition of the movement parameters of the module, an additional controller or communication protocol is necessary. This has to be programmed effortfully ➔ **Higher effort of time and more know-how needed**
Connection for control and supply centralized on the modules with 1 or max. 2 cables	Small effort for wiring (and tubing)	Less moving wires/tubes or feed-throughs necessary ➔ **Saving of cost and time during the assembly** ➔ **Optical upgrade** ➔ **Less required space**		In the pneumatic, tubes for air supply and cables for sensors has to be routed to the actuators. The valves are often local, therefore 1 tube per switching status. Air connections often need much space at the module ➔ **More required space and more time during assembly**	When using modules with controller, min. 1 encoder cable and 1 power cable is needed for each module. These cables also have a thicker cross-section. ➔ **More space required**
Auto-Learn-Function (only valid for ELP)	The motion profile is adjusting automatically according to the attachment weight.	The customer only needs to adjust mechanically the end positions. ➔ **Obvious saving of time during commissioning** ➔ **No know-how in software engineering necessary** ➔ **No misadjustment possible**		The cycle time of pneumatic modules has to be adjusted by using air throttles and sometimes also by adjusting the shock absorber to stop in the end position without vibrations. ➔ **Higher time effort during assembly** ➔ **The risk of misadjustment is existing**	Different parameters have to be defined in the controller or the electronics, before the module starts moving at all. The programming of the movement profil is depending on the moving load, can take up lot of time and is prone to failure. ➔ **Higher effort of time and more know-how neccessary** ➔ **Higher error rate**
	The movement profile is a ramp. Thus, the unit accelerates and brakes automatically to the complete stop, always depending on the total stroke --> No hammering or vibrating in the end position	No shock absorber necessary, therefore no vibration in the end position -> no waiting for the next process step (e.g. in testing applications) ➔ **Process reliability** Minimal wear of parts ➔ **Less efforts and costs**		In the pneumatics, the movement is only decelerated by the shock absorber. During this, vibrations are still occuring and they can have a negative effect on the process. ➔ **No reliable processes**	By using intelligent components, ramps are also be programmed, but maually and very complex with a high effort of time. ➔ **Higher effort of time during commissioning**
Electric linear drive	Constantly high travel speeds	Reliable and fast cycle times ➔ **High-dynamic and predictable cycle times**		Pneumatic supply often include pressure variations (caused by other consumers). This leads to different cycle times. Pneumatic modules are sometimes slower ➔ **Cycle times are slower and not predictable**	Same technical feature ➔ No specific difference
Modules are working completely electrically	No more air compressor necessary	No need to buy an air compressor (as far as one is not already existing) ➔ **Saving of costs and time**		Compressed air is an expensive medium (efficiency approx. 10%) and has to be generated seperatly. ➔ **High costs and efforts**	The savings in the purchasing costs are equalized by higher module prices and additional components (controller, converter). ➔ **Higher purchasing costs**
Control electronics is completely integrated into the module	No further components necessary for controlling the unit	Less required space in the control cabinet ➔ **Saving of cost and space** No extra components have to be purchased ➔ **Saving in purchasing costs**		Pneumatic modules need valves for actuation ➔ **More required space for valves**	For intelligent modules, a separate external controller is often necessary for each module. It has to be stored in the control cabinet. Purchasing costs and required space is increasing with the number of modules. ➔ **Higher purchasing costs and required space in the control cabinet**
Standardized connections	Standard cables and distributors from different manufacturers can be used	Customer can order at his preferred supplier to his customized conditions. Only few new parts ➔ **Low costs and efforts**		Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controllers are used. Also the cables are often specific for each module and are not standardized. So the customer is tied to the cable manufacturer. ➔ **Higher purchasing costs and efforts**

Target customer: Machine Builder

User group: Design Engineer

Technical feature	Benefit	Customer value	Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
24 V Power supply	24 V power supply already available in many assembly machines (e.g. for sensors)	No extra components, as e.g. converter or controller, needed. ➔ **Saving of purchasing cost** Electric standard-periphery (cable, distributor, …) can be used. ➔ **High standardization rate**	Minimum 2 energy sources necessary for pneumatic components ➔ **Higher purchasing costs and efforts**	Due to missing standards, various modules often need different levels of voltage within the same machine. Extra components, e.g. converter or controller, need to be used. Additionally, there is always a specific periphery necessary ➔ **High purchasing costs and lower standardization**
	Consistent power supply	The same power source /power supply can be used for several modules (Exception:ELP) ➔ **High standardization rate** Summarizing of signals and supply with standard distributor ➔ **Low effort of wiring**	Minimum 2 energy sources necessary for pneumatic components: 1.) Compressed air as power supply 2.) 24 V for sensors ➔ **Double effort for energy supply**	The power supply of intelligent components often depends on the controller. Due to missing standards, this can differ a lot by different modules/controllers. Thus, this causes different levels of voltage within the same machine, which is why extra components, e.g. converters, need to be used. ➔ **High purchasing costs and lower standardization**
	Voltage is in low voltage range	Other protection class according to the norm, therefore the necessary and legal safety arrangements for the machine are definitely lower. ➔ **Less efforts and costs**	In pneumatics, there is generally no high voltage necessary as well ➔ **No difference in the level of voltage**	Many controller and modules work by and intermediate circuit voltage up to 560 V, which causes higher safety measures. ➔ **Higher costs and efforts**
Actuation with digital signals (I/O)	Communication is working from the PLC control directly to the modules	No extra components (e.g. controller/valves) necessary. Therefore more space in the control cabinet ➔ **Saving of costs and space**	The customer additionally needs valves for actuating pneumatic components. These are placed on the valve terminal, which also requires space. ➔ **More required space**	The customer additionaly needs one controller in the control cabinet for each module or a particular communitcation protocol ➔ **Higher purchase cost and required space in the control cabinet**
Connection for control and supply centralized on the modules with 1 or max. 2 cables	Especially for ELP: All cable plugs at the fixed back of the module	Only few moving cables ➔ **Longer life of complete machine** Easy cable routing ➔ **Saving of time during assembly** Less required space ➔ **Saving of space**	One air connection on each side of a pneumatic module because of separate piston chambers. Thus, different tube lengths are necessary and they often move as well. Increasing problem by liner modules with big strokes. ➔ **Less lifetime of the machine**	At intelligent components, the measuring system and the motor are placed on the slide (e.g. LDx). Generally this is moving as well. ➔ **Risk of cable break** ➔ **Low lifetime of the machine**
	Small effort for wiring (and tubing)	Less moving wires/tubes or feed-throughs necessary ➔ **Saving of costs and time during the assembly** ➔ **Optical upgrade** ➔ **Less required space**	In the pneumatic, tubes for air supply and cables for sensors has to be routed to the actuators. The valves are often local, therefore 1 tube per switching status ➔ **More required space and more time during assembly**	When using modules with controller, min. 1 encoder cable and 1 power cable is needed for each module. These cables also have a thicker cross-section. ➔ **More space required**
Auto-Learn-Function (only valid for ELP)	The movement profile is a ramp. Thus, the unit accelerates and brakes automatically to the complete stop, always depending on the total stroke --> No hammering or vibrating in the end position	Nos hock absorber necessary, therefore no vibration in the end position -> no waiting for the next process step (e.g. in testing applications) ➔ **Process reliability** Minimal wear of parts ➔ **Less efforts and costs**	In the pneumatics, the movement is only decelerated by the shock absorber. During this, vibrations are still occuring and they can have a negative effect on the process. ➔ **No reliable processes**	By using intelligent components, ramps are also be preogrammed, but manually and very complex with a high effort of time. ➔ **Higher effort of time during commissioning**
Electric linear drive	Constantly high travel speeds	Reliable and fast cycle times ➔ **High-dynamic and predictable cycle times**	Pneumatic supply often include pressure variations (caused by other consumers). This leads to different cycle times. And pneumatic modules are sometimes slower. ➔ **Cycle times are slower and not predictable**	Same technical feature ➔ No specific difference
Control electronics is completely integrated into the module	No further components for control of the unit necessary	Less required space in the control cabinet ➔ **Saving of cost and space** No extra components have to be purchased ➔ **Saving in purchasing costs**	Pneumatic modules need valves for actuation ➔ **More required space for valves**	For intelligent modules, a separate external controller is often necessary for each module. It has to be stored in the control cabinet. Purchasing costs and required space is increasing with the number of modules. ➔ **High purchasing costs and required space in the control cabinet**

Target customer: Machine Builder

User group: Commissioning Engineer

Technical feature	Benefit	Customer value	Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
24 V Power Supply	24 V power supply already available in many assembly machines (e.g. for sensors)	No extra components needed, e.g. converter or controller ➔ **Saving of purchasing cost** Electric standard-periphery (cable, distributor, …) can be used. ➔ **High standardization rate**	Minimum 2 energy sources necessary for pneumatic components ➔ **Higher purchasing costs and efforts**	Due to missing standards, various modules often need different levels of voltage within the same machine. Extra components, e.g. converter or controller, need to be used. Additionally, there is always a specific periphery necessary ➔ **Higher purchasing costs and low standardization**
	Consistent power supply	The same power source /power supply can be used for several modules (Exception: ELP) ➔ **High standardization rate** Summarizing of signals and supply with standard distributor ➔ **Low effort of wiring**	Minimum 2 energy sources necessary for pneumatic components: 1.) Compressed air as power supply 2.) 24 V for sensors ➔ **Higher purchasing costs**	The power supply of intelligent components often depends on the controller. Due to missing standards, this can differ a lot by different modules/controllers. Thus, this causes different levels of voltage within the same machine, which is why extra components, e.g. converters, needs to be used. ➔ **High purchasing costs and lower standardization**
	Voltage is in low voltage range	Other protection class according to the norm, therefore necessary safety arrangements for the machine are lower ➔ **Less efforts and costs**	In pneumatics, there is generally no high voltage necessary as well ➔ **No difference in the level of voltage**	Many controller and modules work by an intermediate circuit voltage up to 560 V, which causes higher safety measures. ➔ **Higher costs and efforts**
Actuation with digital signals (I/O)	No complex programming necessary --> easy commissioning	Fast commissioning No or rather little know-how in software engineering necessary ➔ **Saving of costs and space**	In the pneumatics, the valve is actuated with digital I/O. ➔ No difference	For the definition of the movement parameters of the module, an additional controller or communication protocol is necessary. This has to be programmed effortfully ➔ **Higher effort of time and more know-how needed**
	Communication is working from the SPS control directly to the modules	No extra components (e.g. controller/valves) necessary. Therefore more space in the control cabinet ➔ **Saving of cost and time**	The customer additionally needs valves for actuating pneumatic components. These are placed on the valve terminal, which also requires space. ➔ **More required space**	The customer additionaly needs one controller in the control cabinet for each module or a particular communication protocol. ➔ **Higher purchase costs and required space in the control cabinet**
Connection for control and supply centralized on the modules with 1 or max. 2 cables	All cable plugs at the fixed back of the module	Only few moving cables ➔ **Longer life of complete machine** Easy cable routing ➔ **Saving of time during assembly** ➔ **Saving of space**	One air connection on each side of a pneumatic module because of separate piston chambers. Thus, different tube lengths are necessary and they often move as well. Increasing problem by linear modules with big strokes. ➔ **Less lifetime of the machine**	At intelligent components, the measuring system and the motor are placed on the slide (e.g. LDx). Generally this is moving as well. ➔ **Risk of cable break** ➔ **Low lifetime of the machine**
	Small effort for wiring (and tubing)	Less moving wires/tubes or feed-throughs necessary ➔ **Saving of cost and time during the assembly** ➔ **Optical upgrade** ➔ **Less required space**	Tubes for air supply and cables for sensors have to be routed to the actuators. The valves, tubes and air connections need space. ➔ **More required space** ➔ **Higher time effort during assembly**	When using modules with controller, min. 1 encoder cable and 1 power cable is needed for each module. These cables also have a thicker cross-section. ➔ **More space required**
Auto-Learn-Function (only valid for ELP)	The motion profile is adjusting automatically according to the attachment weight.	The customer only needs to adjust mechanically the end positions. ➔ **Obvious saving of time during commissioning** ➔ **Few know-how in software necessary** ➔ **No misadjustment possible**	The cycle time of pneumatic modules has to be adjusted by using air throttles and sometimes also by adjusting the shock absorber to stop in the end position without vibrations. ➔ **Higher time effort during assembly** ➔ **The risk of misadjustment is existing**	Different parameters have to be defined in the controller or the electronics, before the module starts moving at all. The programming of the movement profil is depending on the moving load, can take up a lot of time and is prone to failure. ➔ **Higher effort of time and more know-how necessary** ➔ **Higher error-proneness**
	The motion profile and the cycle time is adjusting automatically according to the attachment weight.	No misadjustment possible (intuitive control concept) ➔ **Longer maintenance cycles** ➔ **Longer lifetime of the module and the complete machine and therefore less overheads**	Misadjustment of throttles or shock absorbers can lead to a high wear and to a bad performance of the complete machine ➔ **Performance can not be reached** ➔ **Frequent replacement of shock absorbers** ➢ **Production downtime**	Failures in programming of an intelligent module can generally not be excluded. Furthermore, the programming takes up a lot of time during commissioning. ➔ **Misadjusment still possible** ➔ **Higher effort of time**
Control electronics is completely integrated into the module	No further components for control of the unit necessary	Less required space in the control cabinet ➔ **Saving of costs and space** No extra components have to be purchased ➔ **Saving in purchasing costs**	Pneumatic modules needs valves for actuation ➔ **More required space for valves**	For intelligent modules, a separate external controller is often necessary for each module. It has to be stored in the control cabinet. Purchasing costs and required space is increasing with the number of modules. ➔ **Higher purchasing costs and required space in the control cabinet**
Standardized connections	Standard cables and distributors from different manufacturers can be used	Customer can order at his preferred supplier to his customized conditions. Only few new parts ➔ **Low costs and efforts**	Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controllers are used. Cables are often specific for each module and not standardized. So the customer is tied to the cable manufacturer. ➔ **High purchasing costs and efforts**

Target customer: Machine Builder

User group: Software engineer

Technical feature	Benefit	Customer value	Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
Actuation with digital signals (I/O)	No complex programming necessary --> easy commissioning	Fast commisssioning No or rather little know-how in software engineering necessary ➔ **Saving of costs and time**	In the pneumatics, the valve is actuated with digital I/O. ➔ No difference	For the definition of the movement parameters of the module, an additional controller or communication protocol is necessary. This has to be programmed effortfully ➔ **Higher effort of time and more know-how needed**

Target customer: End Customer

User group: Purchasing

Technical feature	Benefit	Customer value 	Disadvantages/Differences of pneumatic 	Disadvantages/Differences of intelligent mechatronics 
24 V Power Supply	24 V power supply already available in many assembly machines (e.g. for sensors)	No extra components, as e.g. converter or controller, needed. ➔ **Saving of purchasing costs** Electric standard-periphery (cable, distributor, …) can be used. ➔ **High standardization rate**	Minimum 2 energy sources necessary for pneumatic components ➔ **Higher purchasing costs and efforts**	Due to missing standards, various modules often need different levels of voltage within the same machine. Extra components, e.g. converter or controller, need to be used. Additionally, there is always a specific periphery necessary ➔ **Higher purchase costs and low standardization**
No wear parts (only valid for ELP)	Module is maintenance-free	Production breakdowns due to maintenance or repairs can be avoided (install and forget) ➔ **Saving of cost and time**	There are always wear parts in pneumatic modules. Either seals or shock absorbers, after a certain number of cycles, parts have to be replaced. ➔ **Cost for maintenance and spare parts**	Same technical feature ➔ **No specific difference**
Modules are working completely electrically	No more air compressor necessary	No need to buy a air compressor (as far as none is already existing) ➔ **Saving of cost and time**	Compressed air is an expensive medium (efficiency approx. 10%) and has to be generated separately. ➔ **High costs and efforts**	The savings in the purchasing costs are equalized by higher module prices and additional components (controller, converter). ➔ **Higher purchasing costs**
Standardized connections	Standard cables and distributors from different manufacturers can be used	Spare parts are in stock, either by customer or by supplier. Customer can order at his preferred supplier to customized conditions. No effortful purchasing of specific spare parts (e.g. controller) ➔ **Low costs and efforts**	Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controllers are used. Also the cables are often specific for each module and are not standardized. So the customer is tied to the cable manufacturer. ➔ **High purchasing costs and efforts**

Target customer: End customer

User group: Standardization Manager

Technical feature	Benefit	Customer value		Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
					
24 V Power Supply	Consistent power supply	The same power source /power supply can be used for several modules (Exception: ELP) ➔ **High standardization rate** Summarizing of signals and supply with standard distributor ➔ **Low effort of wiring**		Minimum 2 energy sources necessary for pneumatic components: 1.) Compressed air as power supply 2.) 24 V for sensors ➔ **Double effort for energy supply**	The power supply of intelligent components often depends on the controller. Due to missing standards, this can differ a lot by different modules/controllers. Thus, this causes different levels of voltage within the same machine, which is why extra components, e.g. converters, needs to be used. ➔ **Higher purchasing costs and lower standardization**
No wear parts (only valid for ELP)	Module is maintenance-free	Production breakdowns due to maintenance or repairs can be avoided (install and forget) ➔ **Saving of cost and time**		There are always wear parts in pneumatic modules. Either seals or shock absorbers, after a certain number of cycles, parts have to be replaced. ➔ **Costs for maintence and spare parts**	Same technical feature ➔ No specific difference
Quite traversing motion of the electric drives	Noticeably less volume of the complete machine	Noise pollution of the complete production in the plant is low ➔ **Higher safety**		Pneumatic modules cause noise by emanating air and movements ➔ **Higher noise pollution**	Same, possibly high whistling sound due to high voltage frequency ➔ **Slightly higher noise level**

Target customer: End customer

User group: Production Planner

Technical feature	Benefit	Customer value		Disadvantages/Differences of pneumatic	Disadvantages/Differences of intelligent mechatronics
Actuation with digital signals (I/O)	No complex programming necessary --> easy commissioning	Saving of time when re-comissioning after facility stop No or rather little know-how in software engineering necessary ➔ **Saving of costs and time**		In the pneumatics, the valve is actuated with digital I/O. ➔ No difference	No effortful re-programming when changes occur in production process ➔ **Higher time effort and more Know-How necessary**
	Communication is working from the PLC control directly to the modules	No extra components (e.g. controller/valves) necessary. Therefore more space in the control cabinet ➔ **Saving of costs and space**		The customer additionally needs valves for actuating pneumatic components. They are placed on the valve terminal. ➔ **More required space**	The customer additionaly needs one controller in the control cabinet for each module or a particular communication protocol ➔ **Higher purchase cost and required space in the control cabinet**
Connection for control and supply centralized on the modules with 1 or max. 2 cables	Small effort for wiring (and tubing)	Less moving wires/tubes or feed-throughs necessary ➔ **Saving of cost and time during the assembly** ➔ **Optical upgrade** ➔ **Less required space**		In the pneumatics, tubes for air supply and cables for sensors have to be routed to the actuators. Valves are often local, therefore 1 tube per switching status. Air connections often need much space at the module ➔ **More required space and time effort during assembly**	When using modules with controller, min. 1 encoder cable and 1 power cable is needed for each module. These cables also have a thicker cross-section. ➔ **More space required**
Auto-Learn-Function (only valid for ELP)"	The motion profile and the operating is adjusting automatically according to the attachment weight.	No misadjustment possible (intuitive control concept) ➔ **Longer maintenance cycles** ➔ **Longer lifetime of the module and the complete machine and therefore less overheads**		Misadjustment of throttles or shock absorbers can lead to a high wear and to a bad performance of the complete machine ➔ **Performance can not be reached** ➔ **Frequent replacement of shock absorbers** ➢ **Production downtime and higher cost of operation**	Failures in programming of an intelligent module can generally not be excluded. Furthermore, the programming takes up a lot of time during commissioning. ➔ **Higher time effort and more know-how necessary** ➔ **Higher error-proneness**
	The movement profile is a ramp. Thus, the unit accelerates and breaks automatically up to the complete stop, always depending on the total stroke --> No hammering or vibrating in the end position	No shock absorber necessary, therefore no vibration in the end position -> no waiting for the next process step (e.g. in testing applications) ➔ **Process reliability** Minimal wear of parts ➔ **Less efforts and costs**		In the pneumatics, the movement is only decelerated by the shock absorber. During this, vibrations are still occuring and they can have a negativ effect on the process. ➔ **No reliable processes**	When using intelligent components, movement ramps are also programmed, but this is done manually, very complex and with a high effort of time. ➔ **Higher effort of time during commissioning**
	During the learning stage, the module is still doing a complete stroke movement	The customer can already work effectively with the first stroke ➔ **Saving of time when re-comissioning**		If the module is not replaced, there is no disadvantage ➔ No difference	Intelligent components have integrated a measuring system, which firstly has to reference after restarting. ➔ **Higher effort of time**
Electric linear drive	Constantly high travel speeds	Reliable and fast cycle times ➔ **High-dynamic and predictable cycle times**		Pneumatic supply often include pressure variations (caused by other consumers). This leads to different and slow cycle times. ➔ **Cycle times are slower and not predictable**	Same technical feature ➔ No specific difference
No wear parts (only valid for ELP)	Module is maintenance-free	Production breakdowns due to maintenance or repairs can be avoided (install and forget) ➔ **Saving of costs and time**		Pneumatic modules always have wear parts in. After a certain number of cycles, seals or shock absorbers have to be replaced. ➔ **Costs for maintence and spare parts**	Same technical feature ➔ No specific difference
Quite traversing motion of the electric drives	Noticeably less volume of the complete machine	Nosie pollution oft he complete production in the plant is low ➔ **Higher safety**		Pneumatic modules cause noise by emanating air and movements ➔ **Higher noise pollution**	Same, possibly high whistling sound due to high voltage frequency ➔ **Slightly higher noise level**
Modules are working completely electrically	No more air compressor necessary	No need to buy a air compressor (as far as none is already existing) ➔ **Saving of costs and time**		Compressed air is an expensive medium (efficiency approx. 10%) and has to be generated separately. ➔ **High costs and efforts**	The savings in the purchasing costs are equalized by higher module prices and additional components (controller, converter). ➔ **Higher purchasing costs**
Control electronics is completely integrated into the module	No further components for control of the unit necessary	Less required space in the control cabinet ➔ **Saving of costs and space** No extra components have to be purchased ➔ **Saving in purchasing costs**		Pneumatic modules need valves for actuation ➔ **More required space for valves**	For intelligent modules, a separate external controller is often necessary for each module. It has to be stored in the control cabinet. Purchasing costs and required space is increasing with the number of modules. ➔ **Higher purchasing costs and required space in the control cabinet**
Standardised connections	Standard cables and distributors from different manufacturers can be used	Customer can order at his preferred supplier to customized conditions. No effortful purchasing of specific spare parts (e.g. controller) ➔ **Low costs and efforts**		Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controllers are used. The cables are often specific for each module and are not standardized. So the customer is tied to the cable manufacturer. ➔ **Higher purchasing costs, effort and time**

Target customer: End customer

User group: Maintenance Staff

Technical feature	Benefit	Customer value 	Disadvantages/Differences of pneumatic 	Disadvantages/Differences of intelligent mechatronics 
24 V Power Supply	24V supply already available in many assembly plants (e.g. for sensors)	No extra components, as e.g. converter or controller, needed. ➔ **Saving of purchasing cost** Electric standard-periphery (cable, distributor, ...) can be used. ➔ **High standardization rate**	Minimum 2 energy sources necessary for pneumatic components ➔ **Higher purchasing costs and efforts**	Due to missing standards, various modules often need different levels of voltage within the same machine. Extra components, e.g. converter or controller, need to be used. Additionally, there is always a specific periphery necessary ➔ **Higher purchase costs and low standardization**
	Voltage is in low voltage range	Other protection class according to the norm, therefore the necessary and legal safety arrangements for the machine are definitely lower. ➔ **Less efforts and costs**	In pneumatics, there is generally no high voltage necessary as well ➔ **No difference in the level of voltage**	Many controller and modules work by an intermediate circuit voltage up to 560 V, which causes higher safety measures. ➔ **Higher costs and efforts**
Actuation with digital signals (I/O)	No complex programming necessary --> easy commissioning	Saving of time when re-comissioning after facility stop No or rather little know-how in software engineering necessary ➔ **Saving of cost and time**	In the pneumatics, the valve is actuated with digital I/O. ➔ No difference	No effortful re-programming when changes occur in production process. ➔ **Higher time effort and more know-how necessary**
Connection for control and supply centralized on the modules with 1 or max. 2 cables	Small effort for wiring (and tubing)	Less moving wires/tubes or feed-throughs necessary ➔ **Saving of costs and time** ➔ **Optical upgrade** ➔ **Less required space**	In the pneumatics, tubes for air supply and cables for sensors have to be routed to the actuators. The valves are often local, therefore 1 tube per switching status. Air connections often need much space at the module ➔ **More required space and higher time effort during assembly**	When using modules with controller, min. 1 sensor cable and 1 power cable is needed for each module. These cables also have a thicker cross-section. ➔ **More space required**
Auto-Learn-Function (only valid for ELP)	The motion profile is adjusting automatically according to the attachment weight.	The customer only needs to adjust mechanically the end positions when re-commissioning. ➔ **Obvious saving of time during commissioning** ➔ **No know-how in software engineering necessary** ➔ **No misadjustment possible**	Pneumatic components have to be adjusted with air throttles. Additionally, it i soften necessary to adjust the shock absorbers to prevent vibrations in the end positions. ➔ **Higher time effort during comissioning** ➔ **Risk of misadjustment is possible**	Different parameters have to be defined in the controller or the electronics, before the module starts moving at all. The programming of the movement profil is depending on the moving load, can take up a lot of time and is prone to failure. ➔ **Higher effort of time and more know-how necessary** ➔ **Higher error-proneness**
	The motion profile is adjusting automatically according to the attachment weight.	No misadjustment possible (intuitive control concept) and less wear parts ➔ **Longer maintenance cycles and lifetime** ➔ **Low costs of operation**	Misadjustment of throttles or shock absorbers can lead to a high wear and to a bad performance of the complete machine. - Performance can not be reached - Frequent replacement of shock absorbers ➔ **Production downtime and higher cost of operation**	Failures in programming of an intelligent module can generally not be excluded. Furthermore, the programming takes up a lot of time during commissioning. ➔ **Higher effort of time and more know-how necessary** ➔ **Higher error-proneness**
	During the learning stage, the module is still doing a complete stroke movement	The customer can already work effectively with the first stroke ➔ **Saving of time when re-comissioning**	No disadvantage (except for the case of replacement) ➔ No difference	Intelligent components have integrated a measuring system, which at first has to reference after restarting. ➔ **Higher effort of time**
No wear parts (only valid for ELP)	Module is maintenance-free	Production breakdowns due to maintenance or repairs can be avoided (install and forget) ➔ **Saving of cost and time**	There are always wear parts in pneumatic modules. Either seals or shock absorbers, after a certain number of cycles, parts have to be replaced. ➔ **Costs for maintenance and spare parts**	Same technical feature ➔ No specific difference
Standardized connections	Standard cables and distributors from different manufacturers can be used	Customer can order at his preferred supplier to customized conditions. No effortful purchasing of specific spare parts (e.g. controller) ➔ **Low costs and efforts**	Pneumatic connectors and tubes are state of the art ➔ **No specific differences**	Depending on the module, different controllers are used. Also the cables are often specific for each module and are not standardized. So the customer is tied to the cable manufacturer. ➔ **High purchasing costs, effort and time**