

# CNC Hand-Held Operator Station

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*Abstract* – Most machine tools today require some form of handheld operator pendant to perform certain tasks. Part setups, tooling changeovers and general operation of the machine are made much easier with the use of a handheld controller. The current market has several offerings to meet this need. Some offer minimal function with consideration being function over design.



These lack any ability to interface further with the machine and instead concentrate on basic manual operation. Others offer more function with computers and software, but they lack any operator friendly controls for manually operating machines.



There is a lack of designs, that combine these two ideas of basic operator friendly function and the ability to fully interface with the machine. The F1 controller offers basic function in an imaginative design while allowing operators to fully create and edit part setups as well as operate the machine in all CNC modes.

## INTRODUCTION

The desired result of this project is to design a handheld control unit for operating and programming machine tools, not limited to but including hobbers, grinders, lathes, and mills. The control shall have all needed functions for operating the machine in manual modes and automatic functions.

Preferred features include a touchscreen integrated for customer HMI and programming of the machine tool. Needed design work would be the 3D design of a case to contain all components, and internal circuit design to meet all requirements of the controller for control of multi-axis machine tools.

The design should be done so manufacturing can be completed in house at Bourn & Koch, and all parts are readily available. The controller's primary purpose is to make sure the operator can set up and operate the machine comfortably with limited constraints. Also, the handheld controller to be designed shall be visually like a Formula 1 steering wheel. The reason behind the idea is to make the controller more comfortable and exciting to a younger generation of machine operators.

### BACKGROUND

Bourn & Koch currently offer a standard stationary controller on their CNC machine. However, a stationary controller isn't ergonomic enough for the end users to perform part setups and tooling change overs. Therefore, the company wants a handheld controller that is an ergonomic, safe, and visually appealing controller for their CNC machines.

### METHODS AND MATERIALS

Time frame – Time for each operation, collection and work done with different time. To develop the whole controller had several scheduled works for this project. Therefore, the team can make the controller and changes to it in timely manner.



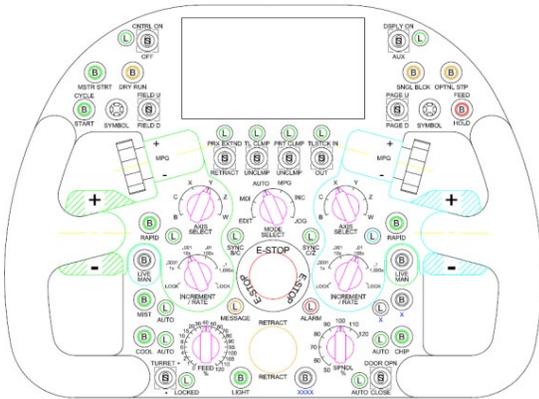
### THE HAND-HELD CONTROLLER MOTIVATION

This product will be a functional prototype for the company. Bourn & Koch's new CNC machine is under construction. The design of this new CNC machine is visually quite attractive: color, angles and other new cool integrated technologies will be part of this machine. Therefore, they need a new design for the controller for the machine. There are other handheld controllers. However, currently there is no such controller that exceeds their expectation in the market. The current controllers on the market are complex and overwhelmed with different types of buttons, switches, and thumb sticks. Bourn & Koch is looking to simplify the handheld controller, reducing the number of buttons needed to operate the machine and locating them in strategic locations for intuitive use.

The current controllers on the market have most of the desired functionality but lack any aesthetic appeal. Bourn & Koch is making a push to give a facelift to the appearance of their machine tools and would like to see this same facelift on the handheld operator interfaces used on the machines. A younger generation of machine operators are coming into the industry, and the hope is to put in their hand something that can feel more familiar.

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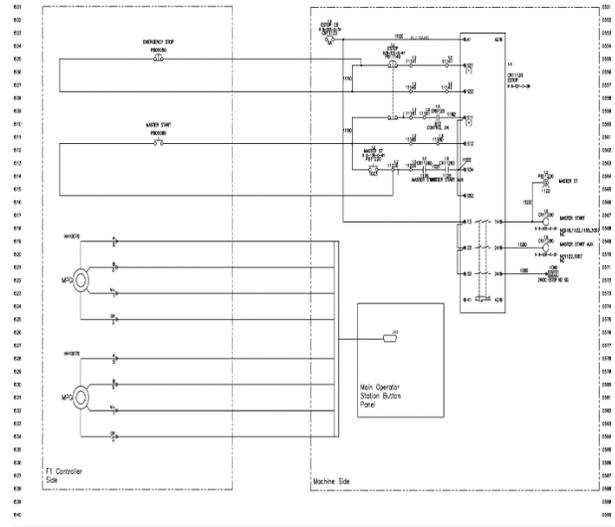
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## CIRCUIT DESIGN

Most physical operators will communicate back to the machines PLC via an I/O module connected to the CNC via ethernet. A standard industrial protocol will be used for this communication called EtherNet IP. It is a protocol widely used in the automation and machine tool industries, which will allow for a smoother integration with the machine tool.

Some components will still need to be hardwired back into the machines safety circuit as well as into specific CNC connectors. Shown below is the integration of the F1 controller's E-stop into the machines safety circuit as well as the controller's MPG's into the CNC's specific connector.



## CONCLUSION

This expansion on what a handheld controller can be will offer users a very in depth experience with the machine as well as a unique experience. The borrowed design elements give a newer generation of machine operators an experience that will more liken to modern video game controllers. This would allow a more familiar feel and potentially a greater expansion of capabilities within the machine tool industry to catch up with the design and capabilities of the future controllers.

## ACKNOWLEDGEMENTS

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