

Development of Lighting Operations Support System

Takashi Takimoto †

Summary: The lighting fixtures required for television studio filming are incandescent lighting fixtures, which are dimmer controlled and can be controlled with just voltage control, so only a power line connection was required. However, with the introduction of LED fixtures, not only was it necessary to connect control lines to the lighting fixtures, which had not been necessary before, but it also required lighting network settings, which dramatically increased the workload. Now, by simply specifying the lighting fixture installation locations in lighting plan drawing software, it has become possible to automate the previously required settings of lighting fixture addresses, network ports, and lighting console network settings. A system has also been developed that can display the lighting fixture installation positions on studio lighting battens and even check the accuracy of the placement after installation. This has significantly reduced the work required to set up the lighting system before filming and to install the lighting on site, resulting in the completion of a new, unprecedented system.

Keywords: Lighting, DMX, RDM (Remote Device Management)

1. Preface

Lighting fixtures in a TV studio are controlled by sending control signals from the lighting console to the fixtures, as shown in Figure 1.

The bulb lighting fixtures could be controlled using a dimmer with only voltage control, and could be operated simply by connecting the power line.

However, with the introduction of LED fixtures, not only did it become necessary to connect control lines to the lighting fixtures, which had not been necessary before, but it also became necessary to set up a lighting network, which dramatically increased the workload.

2. Development Overview

In the TV studio, the art set is displayed in a spectacular way,

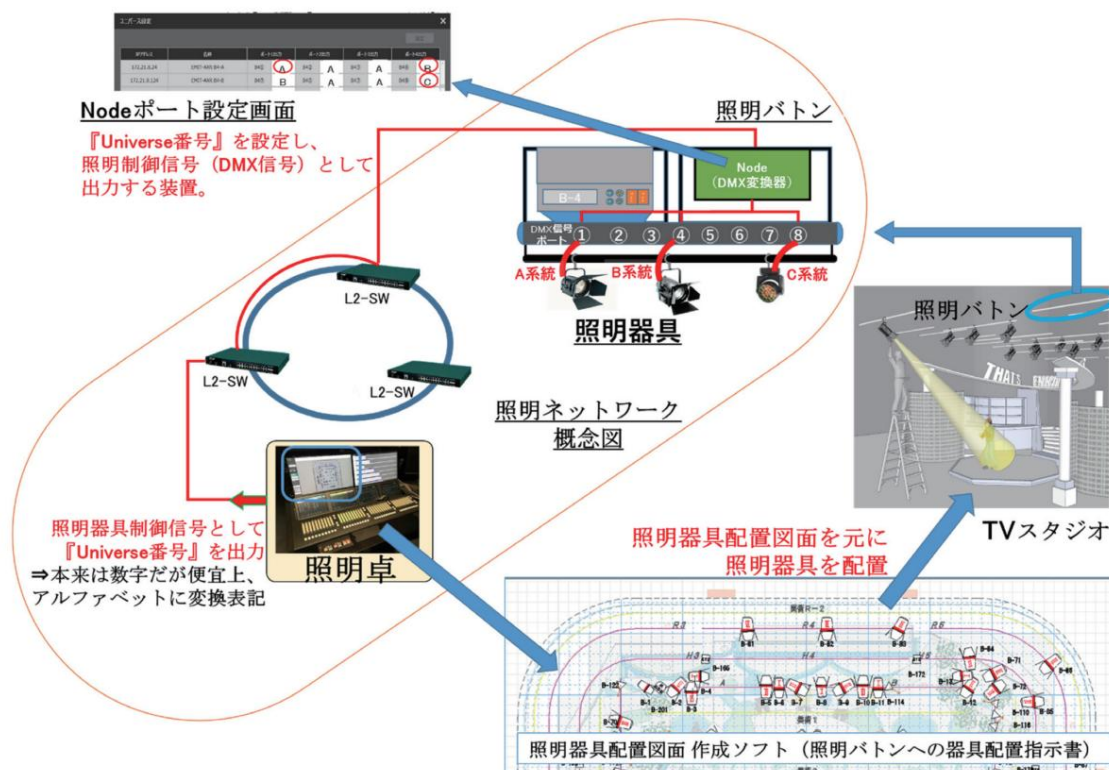


Figure 1. Lighting network image

照明業務支援システムの開発

Development of Lighting Operations Support System

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あらまし テレビスタジオ撮影に必要な照明器具において、電球照明器具は調光器制御のため、電圧制御だけでコントロールでき、電源線接続だけでよかった。しかしLED器具導入に伴い、今まで必要なかった照明器具への制御線の接続だけでなく、照明ネットワーク設定等必要となり業務負荷が格段に増加した。今回、照明プラン図作成ソフト上に照明器具設置位置を指定するだけで、従来必要だった照明器具へのアドレス設定、ネットワークのポート設定、照明卓のネットワーク設定の自動化を実現。またスタジオ照明ボタンへの照明器具設置位置表示や設置後の配置正誤確認まで行えるシステムを開発。撮影前の照明システム設定と現場照明設置作業が大幅に削減され、今までにどこにもない新しいシステムを完成させた。

キーワード：照明，DMX，RDM

1. まえがき

TVスタジオでの照明器具コントロールは図1のように照明卓からの制御信号を照明器具に対して送ることで実行する。電球照明器具は調光器を用いて電圧制御だけでコントロールでき、電源線の接続だけで運用が可能であった。し

かしLED器具導入に伴い、今まで必要なかった照明器具への制御線接続だけでなく、照明ネットワーク設定も必要となり、業務負荷が格段に増加した。

2. 開発概要

TVスタジオでは、美術セットを華やかに見せ、視聴者

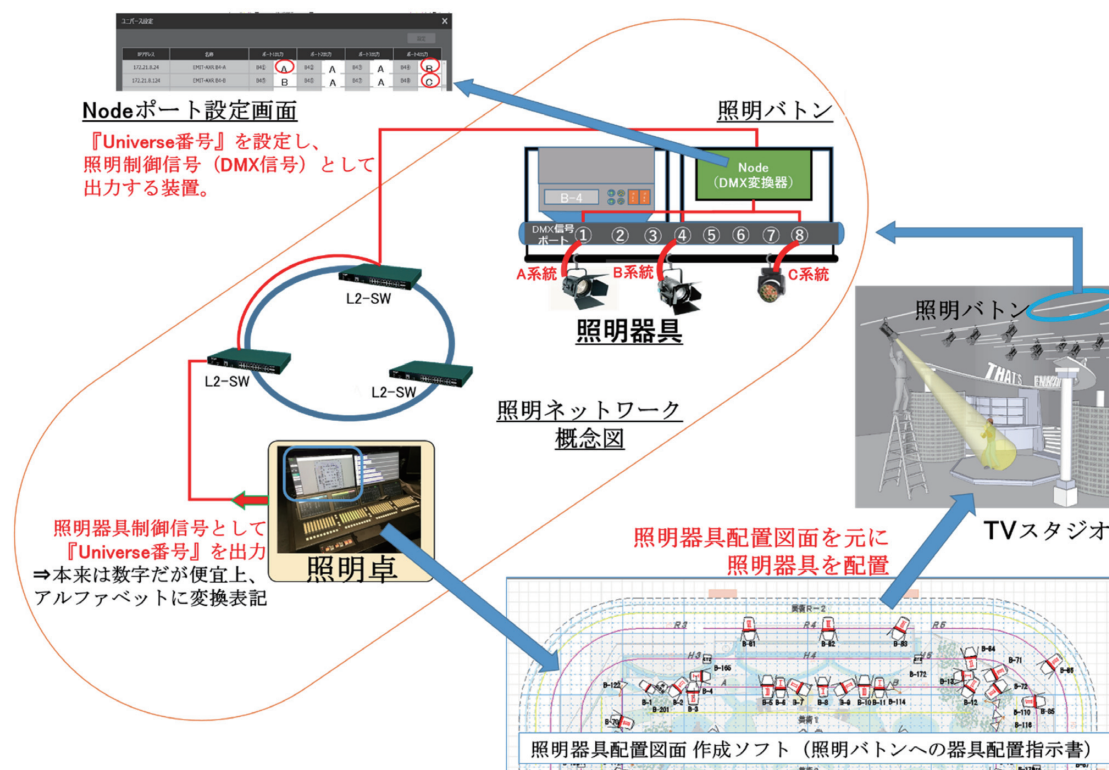


図1 照明ネットワークイメージ

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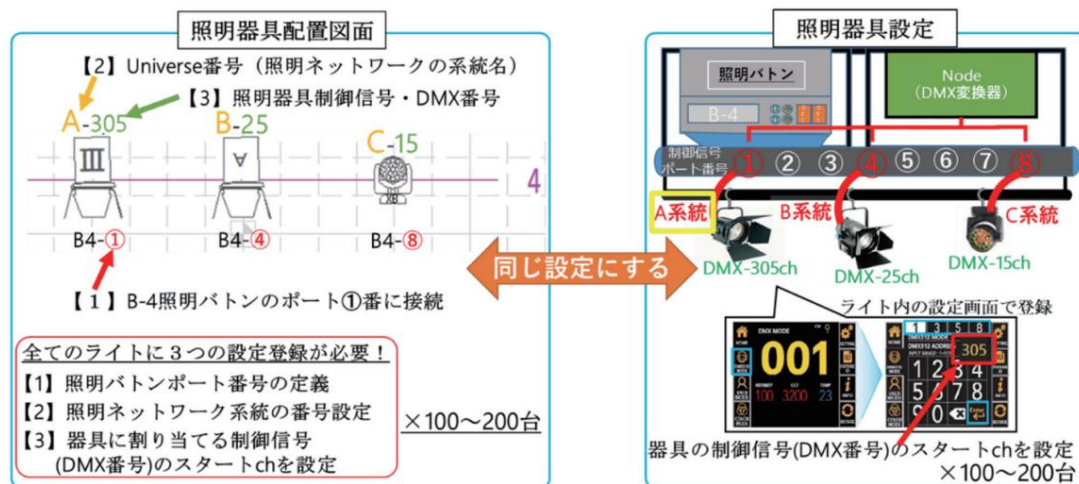


Figure 2. Conventional configuration work items

Many lighting fixtures are required to create programs that are easy for viewers to watch. To control the lighting fixtures, control signals from the lighting console must be transmitted over a lighting network to the lighting fixtures via lighting batons or other devices installed above the studio.

Now, by simply specifying the location of the lighting fixtures on the lighting fixture layout drawing software, we have achieved automation of the previously required setting work for the devices within the lighting network. We have also developed a system that can display the lighting fixture installation positions on the studio lighting batons and even check the correctness of the placement of the lighting fixtures after they have been installed. This significantly reduces the amount of work required for system setup and on-site lighting installation. While LED lighting typically requires additional setup time, this system achieves shorter setup times than when using incandescent lighting fixtures.

The LED lighting fixtures are controlled by the lighting console. DMX address (standardized by the American Institute for Theatre Technology (USITT) communication protocol for lighting fixture control signals) and the By setting the DMX address to the same setting, fixture control becomes possible, and control signals are transmitted from the lighting console through the lighting network (Figure 2).

Asahi Broadcasting Television will be broadcasting all studios from 2022 to 2024. We are planning to convert Geo to all-LED. This will drastically increase the amount of work required, including "connecting control lines (DMX signals) to the lighting fixtures," "setting the system for each DMX signal port on the node that connects the lighting fixtures," and "setting the DMX addresses of the lighting fixtures," which were not previously required when operating with incandescent lighting fixtures. However, with a typical LED equipment upgrade, the previous personnel composition and work time meant that the preparatory work (hanging the lighting fixtures, setting up the lighting console) could not be completed, so measures were needed. This time, we have made two new developments that have made it possible to reduce the work time.

[Development 1] A serial number is assigned to each type of lighting fixture, and each lighting fixture is managed within the lighting system by its [Fixture Number]. The [Fixture Number] is named [K_No.], and a [K_No. List] is created to manage all lighting fixtures in the studio. The [K_No. List] handles the "Fixture Type," "UID (Lighting Fixture Unique Number)," "Universe Number," and "DMX Address," and the fixture symbols are entered into the lighting fixture layout drawing software.

By simply placing the lighting fixture (Fig. 3y1y-) connected to the lighting baton (Fig. 3y2y), the lighting fixture can be installed in accordance with the American National Standards Institute (ANSI) RDM standard.

Once the fixture is recognized through Remote Device Management (a two-way communication standard between the lighting console and lighting fixtures) communication (Figure 3-y3y), the port to which the fixture is connected is automatically changed according to the "Universe Number" registered in the [K_No. List] (Figure 3-y4y). The "Universe Number" and "DMX Address" registered in the [K_No. List] are automatically set for the placed lighting fixture symbol in the lighting fixture layout drawing software (Figure 3-y5y). For studio lighting fixtures, the "DMX Address" is automatically set via RDM communication (Figure 3-y6y). This successfully automated all system settings up to the point where the light is turned on. [Development 2] Strip lights were laid out along the lighting baton, and the lighting

fixture

symbol positions placed in the lighting fixture layout drawing software were lit up on the lighting baton. This has successfully eliminated the previous work of carrying a paper lighting fixture layout diagram and determining the lighting hanging position based on floor dimensions, hand measurements and experience. The display color is changed for each "fixture type" and the correct placement can also be checked when installing lighting fixtures. By changing the display method depending on whether it is correct or not, the lighting fixture installation status can be seen at a glance. When it is recognized that the connection is complete on each baton, the lighting fixture will automatically light up at the specified level, allowing the lighting fixture focusing work to begin smoothly. This has resulted in a system that displays the hanging position on the lighting baton and makes it possible to check whether the fixture connection status is correct or not.

We developed a system.

The "lighting fixture type" and "lighting fixture symbol position" plotted on the drawing were transmitted to each baton via Wi-Fi. The signal received by a microcomputer with Wi-Fi communication function attached to the end of each lighting baton (Fig. 4) was converted into an SPI signal, and the "lighting fixture hanging position lamp" of the full-color strip light attached to the baton was lit (Fig. 5). The light color of the strip light was the same color as the focus knob for pole operation of the lighting fixture and the Velcro attached to the fixture arm (Fig. 6). This allowed the lighting fixture to be easily identified.

The color of the tape light is associated with the color of the light source.

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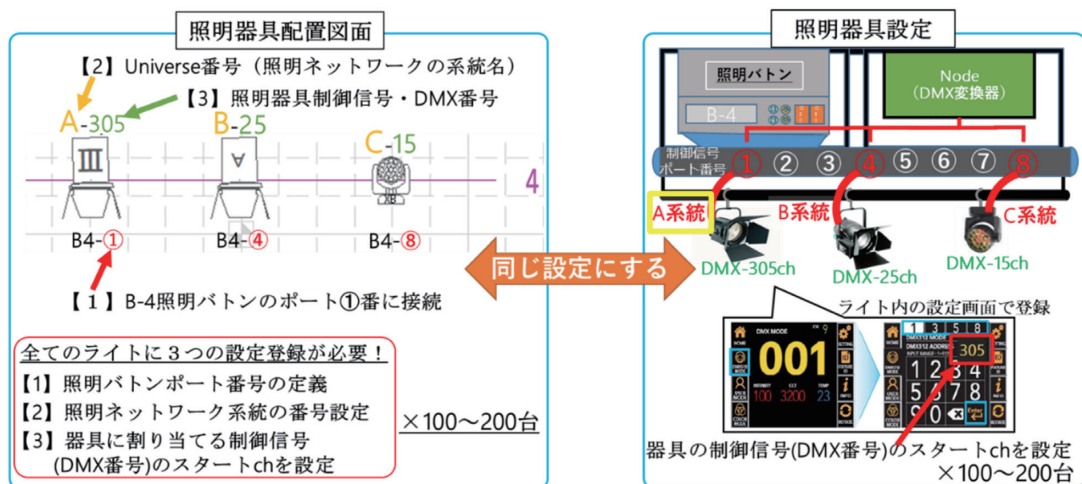


図2 従来の設定作業項目

に見やすい番組を作るために、多くの照明器具を必要とする。照明器具を操るには、照明卓からの制御信号を照明ネットワーク通じて、スタジオ上部に設置されている照明ボタンなどを經由し、照明器具へ伝送する必要がある。

今回、照明器具配置図面作成ソフト上に照明器具設置位置を指定するだけで、従来必要だった照明ネットワーク内機器への設定作業の自動化を実現した。またスタジオ照明ボタンへの照明器具設置位置表示や、照明器具設置後の配置正誤確認まで行えるシステムを開発。撮影前の照明システム設定と現場照明設置作業が大幅に削減され、通常LED化でセッティング時間が増えるところ、電球照明器具利用時よりセッティング作業時間の短縮を実現させた。

LED照明器具のコントロールは、照明卓側で設定したDMXアドレス（米国劇場技術協会・USITTが規格化した照明器具制御信号の通信プロトコル）と、照明器具側のDMXアドレスを同じ設定に合わせることで器具制御が可能となり、照明卓から制御信号を照明ネットワーク通じて伝送し実施する（図2）。

朝日放送テレビでは2022年から2024年にかけて全スタジオのALL-LED化を計画。今まで電球照明器具運用時には必要としなかった『照明器具への制御線（DMX信号）の接続』、『照明器具を接続するNodeの各DMX信号ポートの系統設定』、『照明器具のDMXアドレス設定』等、作業量が格段に増加することに対して、一般的なLED化対応設備更新では、今までの人員構成・作業時間で事前準備作業（照明器具吊込み作業、照明卓セッティング作業）が完了できず、対策が必要だった。今回、2件の新規開発を行うことで、作業時間の短縮を実現させた。

【開発1】

照明器具種ごとに通し番号を振り、照明システム内で各照明器具を【器具番号】で管理。【器具番号】を【K_No.】と名付け、スタジオの照明器具全台数を管理する【K_No.リスト】を作成した。【K_No.リスト】は『照明器具種』、『UID（照明器具固有番号）』、『Universe番号』、『DMXアドレス』を取り扱い、照明器具配置図面作成ソフトに器具シンボル

を配置するだけで（図3-【1】）、照明ボタンに接続された照明器具（図3-【2】）を米国国家規格協会ANSIのRDM規格（Remote Device Management・照明卓と照明器具間での双方向通信規格）通信で認識次第（図3-【3】）、器具が接続されているポートを【K_No.リスト】に登録された『Universe番号』に従い自動変更（図3-【4】）。配置された照明器具シンボルに対しては照明器具配置図面作成ソフト上で【K_No.リスト】に登録されている『Universe番号』、『DMXアドレス』を自動設定（図3-【5】）。スタジオ照明器具に対しては『DMXアドレス』をRDM通信で自動設定（図3-【6】）。これにより、明かりを出すまでのすべてのシステム設定を自動化することに成功した。

【開発2】

照明ボタンに沿ってテープライトを敷設し、照明器具配置図面作成ソフトで配置した照明器具シンボル位置を照明ボタン上で点灯表示させた。これにより今まで紙で照明器具配置図面を携帯しながら床の尺目や手寸法、経験から照明吊り位置を割り出していた作業をなくすことに成功した。『器具種』ごとに表示色を変え、照明器具設置時に配置の正誤確認も実施した。正誤により表示方法を変えることによって、照明器具設置状態が一目瞭然でわかるようにした。各ボタンにおいて接続完了を認識すると規定レベルで照明器具が自動点灯し、照明器具のフォーカシング作業にスムーズに取り掛かれる。これにより、照明ボタンへの吊り位置表示と器具接続状態の正誤確認を可能とするシステムを開発した。

各ボタンに対して、図面プロットした『照明器具種』と『照明器具シンボル位置』をWi-Fiで伝送した。各照明ボタン端部に取り付けたWi-Fi通信機能付きマイコン（図4）で受けた信号をSPI信号に変換し、ボタンに設置したフルカラーテープライトの【照明器具吊り込み位置ランプ】が点灯する（図5）。テープライトの点灯色は照明器具のボールオペレーション用フォーカスノブや器具アームに取り付けたマジックテープと同色にしている（図6）。これにより器具とテープライト点灯色とを関連付け、照明器具の吊込み作

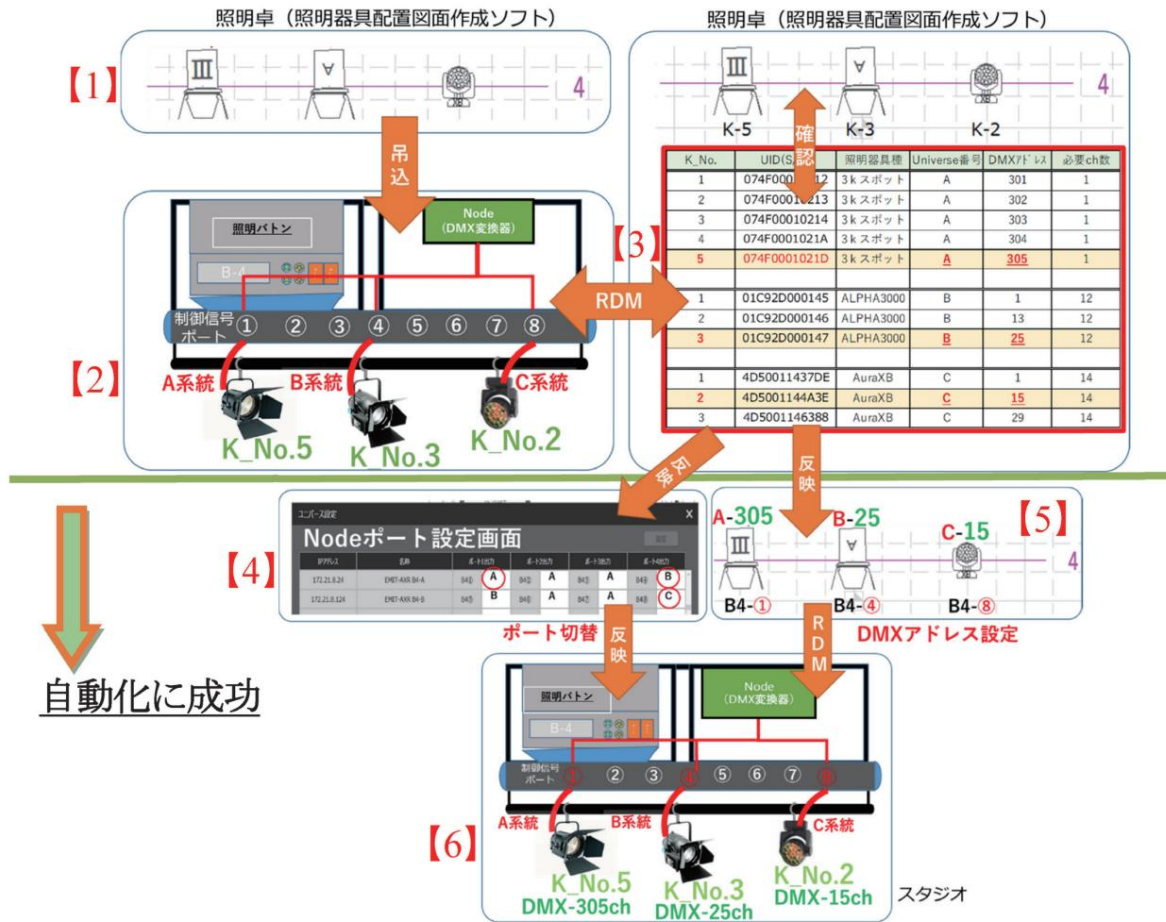


Figure 3: Automating lighting operation settings through [K_No. List] operation



Figure 4: Microcomputer with Wi-Fi functionality



Figure 5: Illuminated display of installation location

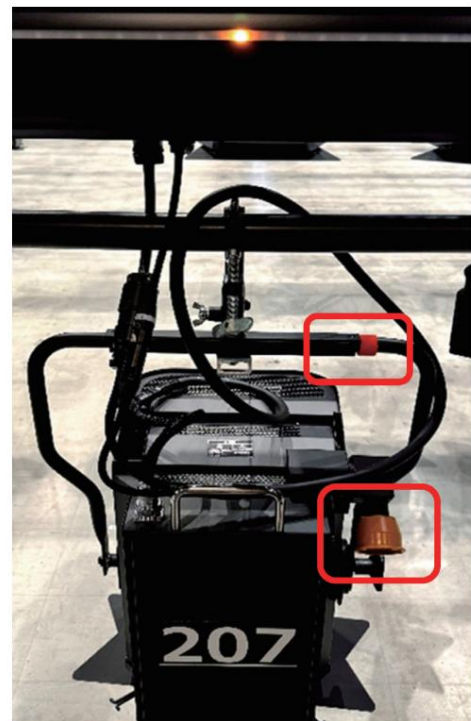


Figure 6: Identification markings

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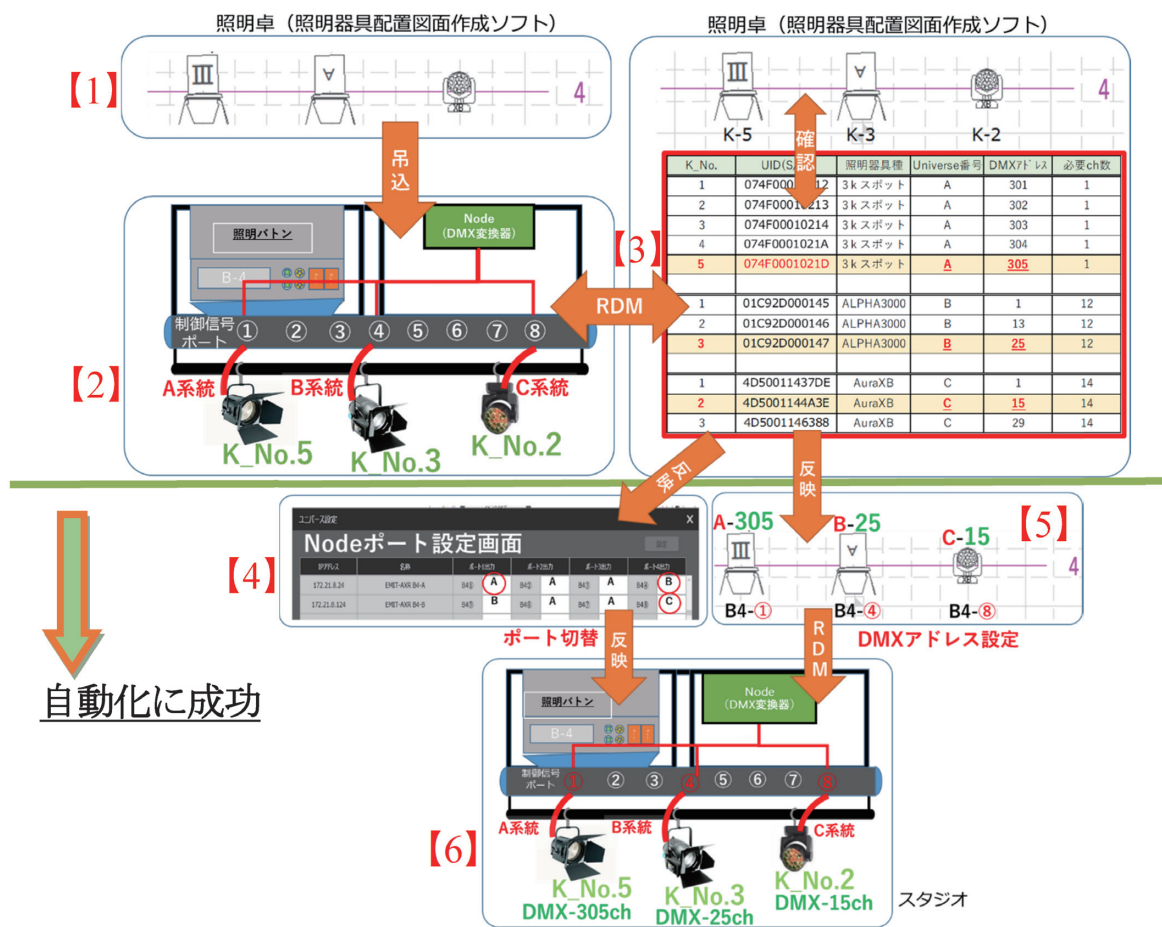


図3 【K_No.リスト】運用による照明業務設定自動化



図4 Wi-Fi機能付きマイコン



図5 設置位置を点灯表示

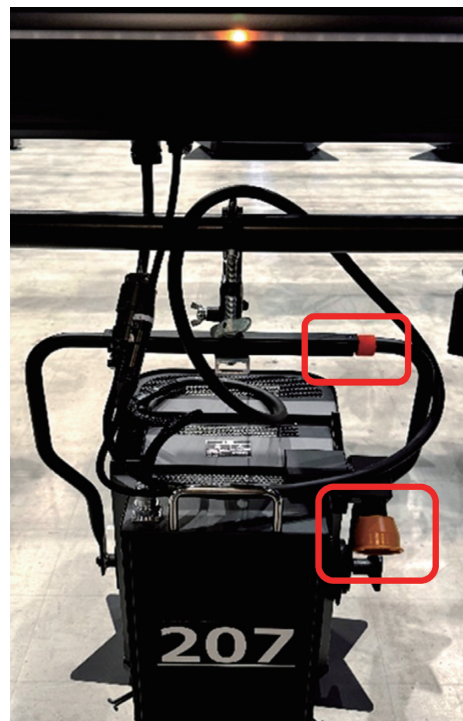


図6 識別表示

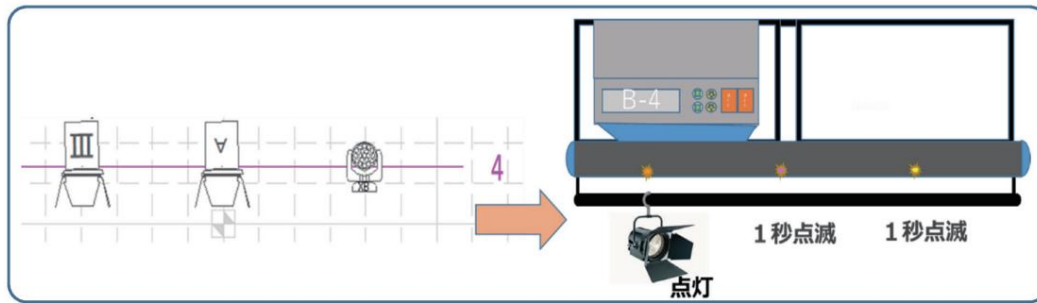


Figure 7 Tape light hanging position indicator

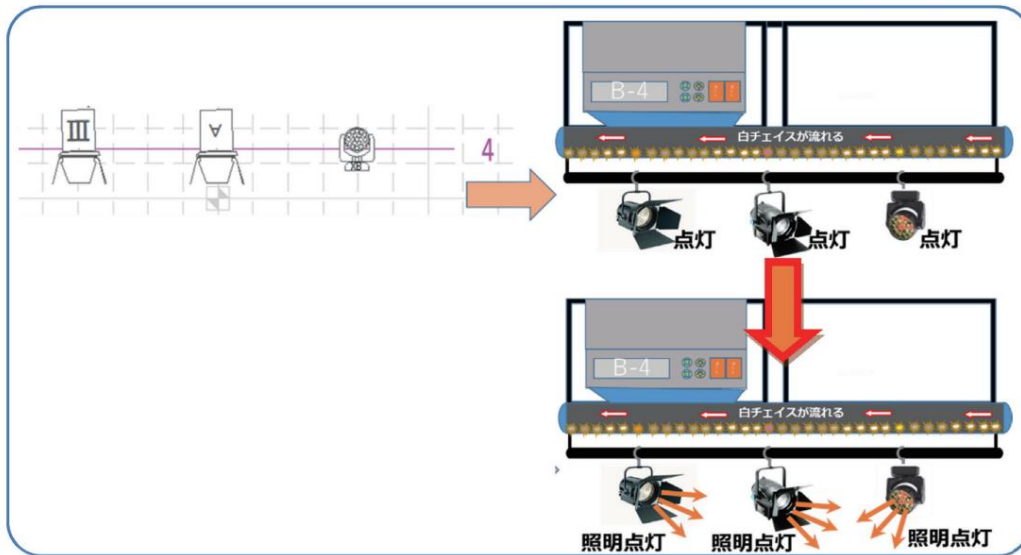


Figure 8 Tape light hanging position lighting display and status change

This makes it easier to determine the type of equipment in the industry (Figure 4).

The fixture connection status is checked from the left side of the studio, and they are placed and connected in order. The RDM function obtains the UID information of the connected lighting fixtures, and if the lighting fixture type in the [K_No. List] matches the fixture type specified in the lighting fixture layout drawing creation software, the lamp in the corresponding location on the tape light will change from "blinking for 1 second" to "lit" (Figure 7). Correctness is confirmed from the left side of the studio, and the light on the right side of the incorrect lighting fixture will flash red to notify that the fixture type is incorrect. If all the lighting fixtures have been installed correctly, a white chase (a mass of white light) will flow across the entire baton tape light, indicating [hanging complete], and the lighting fixtures on the baton will light up (Figure 8). You can then move on to shooting work.

By linking [Development 1 and 2], we have succeeded in significantly reducing the amount of work that was previously required in the series of tasks from creating lighting plan drawings to setting up the lighting table, hanging lighting fixtures, setting addresses, and checking lighting fixture connections.

3. Conclusion

It will begin operation in December 2023. It will be used by Asahi Broadcasting Corporation TV B, including the operation of "Morning! Live Travel Salad" which is broadcast every Saturday morning.

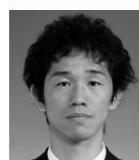
This has resulted in a significant reduction in time during studio operation.

The idea was to set the control information for the console, and set the addresses of the studio equipment and the port settings for the node, but it was changed to set the control information for the studio equipment and the port settings for the node.

By switching to the idea of "fixing the Universe number and DMX address, and then setting the console's control information and Node port settings based on the fixture information being used," we were freed from all lighting network setting operations up to turning on the lights. This resulted in a dramatic reduction in preparation time. It also minimized mistakes during on-site installation work and improved the safety of the work environment by dramatically reducing the number of times the lighting plan drawings had to be looked at. This created an environment where people could concentrate on lighting planning.

Finally, we would like to thank Panasonic for their generous support in the operation of the system.

Finally, we would like to express our deepest gratitude to K.K.



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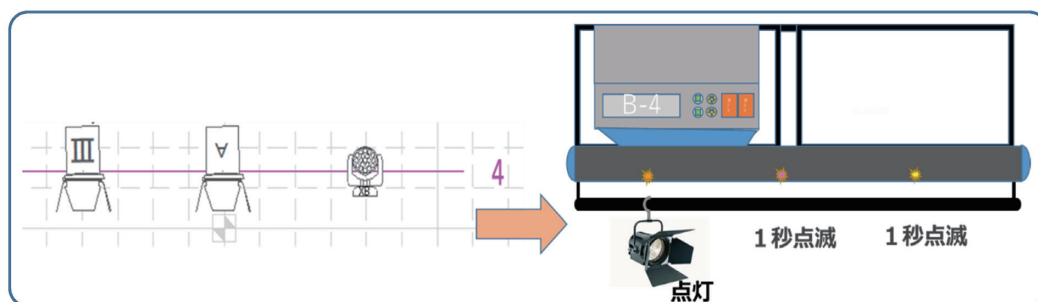


図7 テープライト吊り位置点灯表示

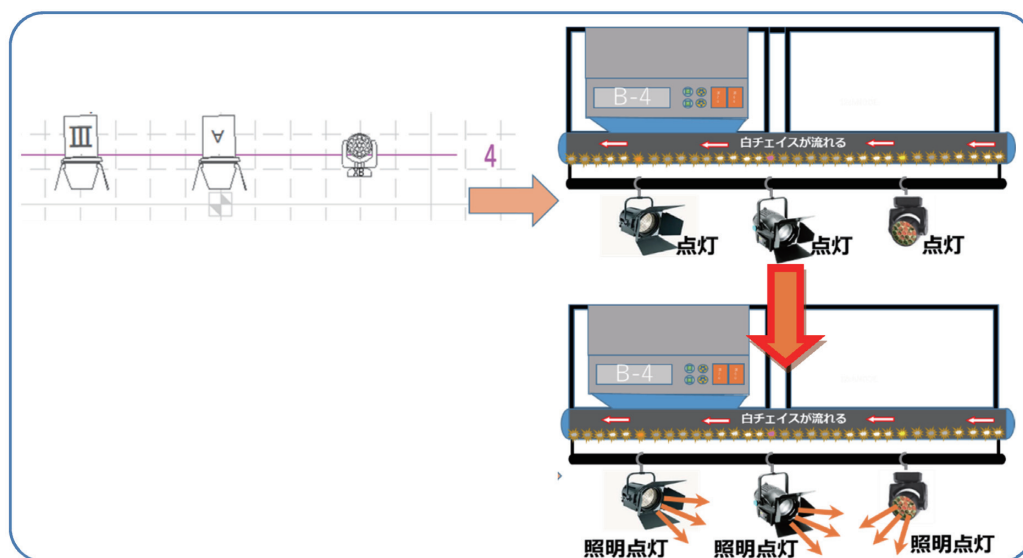


図8 テープライト吊り位置点灯表示と状態変化

業において器具種別判断を容易にしている(図4)

スタジオ下手方向から器具接続状況を確認し、順番に配置・接続していく。RDM機能で接続した照明器具のUID情報を取得し、【K_No.リスト】の照明器具種と、照明器具配置図面作成ソフトで指定されている器具種とが一致すれば、テープライトの該当箇所のランプが『1秒点滅』から『点灯』に変わる(図7)。スタジオ下手から正誤確認するため、間違えた照明器具から上手のライトは赤点滅で器具種間違いを通知する。すべて正しく照明器具を設置できれば、ボタンテープライト全体に白いチェイス(白い明かりの塊)が流れ、【吊り込み完了】を示し、ボタン上の照明器具が点灯(図8)。そのままシューティング作業に移行できる。

【開発1, 2】を連携させることにより照明プラン図面作成から照明卓設定、照明器具吊込み・アドレス設定、照明器具接続確認までの一連の作業において、今まで必要だった作業を大幅に削減することに成功した。

3. むすび

2023年12月から運用開始。毎週、土曜朝に放送している「朝だ！ 生です旅サラダ」の運用含め、朝日放送テレビB

スタジオ運用で大幅な時間削減効果を実現した。今までの『卓の制御情報を設定し、スタジオ器具のアドレスやNodeのポート設定を行う』という発想から、『スタジオ器具のUniverse番号とDMXアドレスを固定し、使用する器具情報から卓の制御情報やNodeのポート設定を行う』という発想に切り替えたことで、ライト点灯までのすべての照明ネットワーク設定操作から解放された。これに伴い劇的な準備時間の削減を実現した。現場吊り込み作業においてミスを極限までなくし、照明プラン図面を見る回数を劇的に減らすことでの作業環境の安全性も高まった。これにより照明プランニングに集中できる環境を創出した。

最後に、運用に多大なるご協力をいただいたパナソニック(株)様に末筆ながら深く感謝申し上げる。



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